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ABSTRACT

This teacher's guide has been written for the elementary classroom teacher as an aid and not as a course of study. The guide lists units of study that might be undertaken in any classroom and indicates objectives, activities, teaching aids, and reference materials that will be helpful in the development of the unit. Topics covered include conservation, geology, soil, seeds, trees, plants in their habitats, bacteria, molds, birds, mammals, reptiles and amphibians, arthropods, fish, pond water, oceanography, light, electricity, magnetism, weather, scientific weights and measurements, space, flight and the senses. The guide includes a listing of free films available from a variety of sources. [Not available in hardcopy due to marginal legibility of original document.] (BB)

ED0 45395

A Teacher's Guide
to

KOLab

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KEMMERER OUTDOOR LAB
SCHOOL DISTRICT NUMBER ONE
Kemmerer, Wyoming

SE 010 113

ED0 45395

A TEACHER'S GUIDE
TO

KOLAB

SCHOOL DISTRICT NUMBER ONE
KEMMERER, WYOMING

KEMMERER OUTDOOR LABORATORY

TEACHERS SCIENCE-UNIT GUIDE BOOK

SCHOOL DISTRICT NO. ONE

KEMMERER, WYOMING

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WELCOME TO THE KEMMERER OUTDOOR LABORATORY

KOLab is an experience in science with the emphasis on the relationships among living organisms and their environment.

It is felt that the experiences the student gains from visiting the KOLab area and being involved as a part of the program will be a stimulus for him in other facets of the school program as well as in science. The KOLab is designed to complement and supplement--not to replace-- the total science curriculum.

The outdoor laboratory area of five acres is located immediately south of the Junior High School building and is open and available to all. Although the KOLab area is a significant part of the program, most of the activity occurs within the classroom and this area is a special classroom in itself.

This booklet has been prepared by classroom teachers who have been involved with the KOLab program throughout the past year and have used it with success. This guide has been written for the classroom teacher as an aid and not as a course of study. This guide lists units of study that might be undertaken in any classroom and indicates objectives, activities, teaching aids, and reference materials that will be helpful in the development of the unit.

The teacher need not feel limited to or dictated to by these units; the students' interests and innate curiosity may direct the class to an interesting topic through a discovery of his own.

The teacher need not know all the answers or fear the undertaking of a topic because of a lack of knowledge relating to that subject. A great deal of science knowledge is more valuable and useable to the student who learns through experimentation and experience.

Materials, supplies, and resource information are available in your classroom building, or library. Special materials or assistance are available from the Jr.-Sr. High School science staff through your principal.

GENERAL OBJECTIVES

1. Students and teachers working with these units can become familiar with fundamental principals and basic scientific principles and equipment
2. Observations, experimentation, the checking of ideas, the recording of data, the use of measurements, and thinking
3. Individual achievement
4. Conservation of Natural Resources
5. An appreciation of nature
6. Gain an awareness of plant and animal relationships

LET'S TAKE A FIELD TRIP

A field trip is an organized study venture extending beyond the walls of the regular classroom. (Taken from Let's Take a Field Trip, Hurd, Paul D.)

Purposes of a field trip:

- a. collecting data
- b. observing phenomena
- c. gathering specimens
- d. identifying relationships
- e, tracing processes

Organization of a Field Trip

1. The teacher should have a general background information concerning the site, plant, locality, etc. of the field trip to give to the students.
2. Have a study guide consisting of a short description of the need and specific purposes of the trip, a map, tours which will be given, etc., prepared by the teacher and/or the students.
3. The teacher has the responsibility of maintaining discipline throughout the field trip to insure a maximum learning situation for the students.
4. Preplanning the field trip should include these details:

a. location of resource center (field trip)

b. time schedule

c. route which will be taken

d. class organization at the resource center

e. transportation

f. standard forms for parental permission, approval by the principal, and requests if any

g. check with your principal before organizing the trip

h. costs, if any, such as transportation, admissions, fees, meals, etc.

i. liability for accidents

j. special permits if needed (state and national parks and game preserves require these).

k. evaluation, and follow-up procedure, back in the classroom after the field trip

l. sponsors or chaperones

SUGGESTED FIELD TRIPS

1. KOLab
2. Utah Power and Light Plant
3. Elk feeding grounds in Jackson, Wyoming
4. Big Springs, near Elk Creek camp ground
5. Fish hatchery in Star Valley
6. Fort Bridger Natural Museum
7. FMC
8. Gas plant in Opal, Wyoming

REFERENCES

Let's Take a Field Trip, Hurd, Paul DeH. LMC
How To Lead a Field Trip, Audubon Nature Bulletin #13

Leading Children in the Field

BEFORE THE TRIP

1. Have an Objective
2. Make it exciting
3. Know your Subject
4. Know your Trail
5. Prepare group in advance

PREPARE
YOURSELF

PREPARE
YOUR GROUP

DURING THE TRIP - RULES AND REGULATIONS

1. Explain the rules
2. Keep order
3. Stay behind the leader
4. Gather around

ORDER

5. Stay on the trail
6. Watch your feet
7. Prepare for emergencies

SAFETY

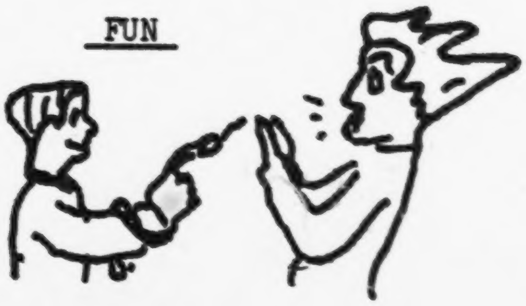
8. Good outdoor manners
9. Practice conservation

CONSERVATION

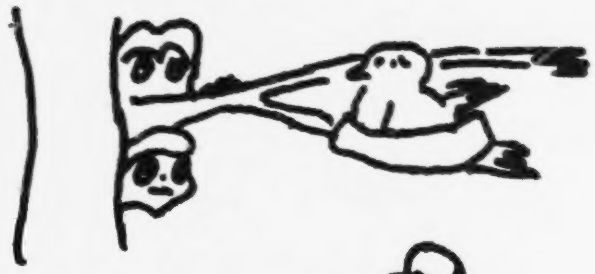
DURING THE TRIP - TECHNIQUES

1. Explain objectives
2. Move out rapidly
3. Walk casually
4. Talk conversationally
5. Stop to look
6. Prepare for surprises
7. Keep stops short
8. Use serial method
9. Use games
10. Encourage discovery
11. Use all senses
12. Climax the trip
13. Watch length
14. Conclude

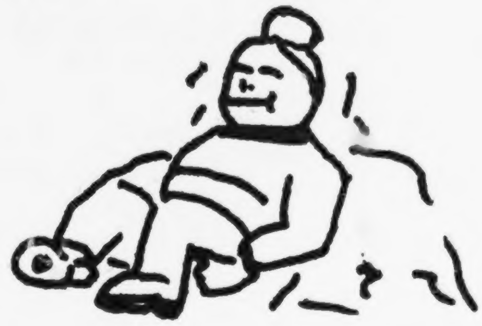
FUN



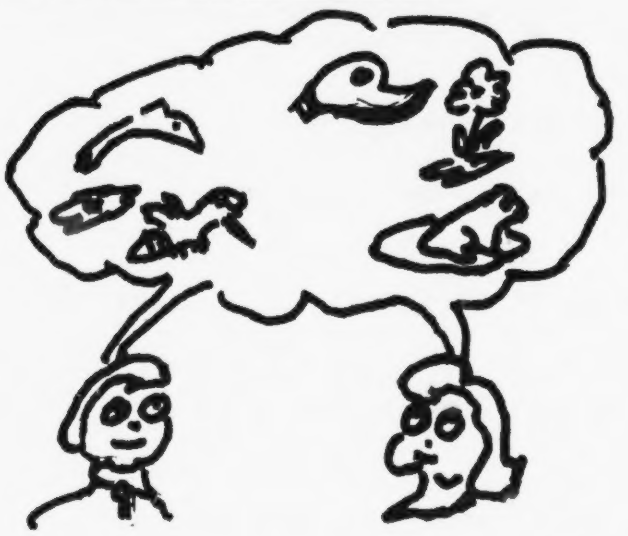
FACTS



FATIGUE



SUMMARIZE AND FOLLOW-UP



Memories

UNIT 1

CONSERVATION

TERMS

Conservation - The wise use, or the practice of saving resources

Erosion - The wearing away of rocks and top soil by the forces of nature

Sediment - Materials that are carried by water and then dropped

Topsoil - The top layer of soil which contains all the minerals necessary for good growth

Contour plowing - Plowing around a hill, rather than vertically

Shelterbelt (windbreak) - Trees planted in such a way so as to prevent erosion and to provide an area free from nature's forces

Pollution - Contamination by smog, sewage, etc.

Smog - A fog made heavier and darker by smoke and chemical fumes

Crop rotation - Planting crops in different fields, letting the soil "rest"

Watershed - The water sources and coverage of a certain area

Natural Resources Plants, soil, minerals, and wildlife

THINGS TO FIND OUT

1. What does the word "conservation" mean?
2. What causes soil erosion?
3. Which part of the soil is the "topsoil"?
4. What are some methods farmers can use to prevent the wearing out of their land?
5. Name some of our natural resources found in Wyoming, and around the Kemmerer area.
6. What does the word "polluation" mean?
7. What makes up "smog"?
8. Name two things man has done to cause erosion.
9. What happens when the top soil is washed away?
10. How does fire endanger our conservation of natural resources?
11. What are ways in which we can conserve water?
12. What is the purpose of crop rotation?
13. Explain these terms, and how they are related to conservation of soil: terracing, mulching, drainage, irrigation, woodland management, stripcropping, watershed.
14. How did the dust storms of the thirties affect the people of the Great Plains?
15. How would a permanent dust bowl affect the meat-packing industry and grain exchange of Chicago?
16. What are the damages to public health and wildlife when there is pollution of streams from city sewage and factory waste?
17. Name some effects of soil erosion.
18. Discuss the uses of forests, forest products, and forests in Wyoming. What are the causes and effects of forest fires?
19. What are some ways in which we take care of vegetables and flower gardens and grass on the lawns?

TERMS

Extinct - No longer living

Refuge (reserve, preserve) - An area set aside to provide shelter or protection of animals to prevent extinction

Renewable resources - Resources which can be used without destroying them

QUESTIONS

1. How do soil, water, plantlife, and animals depend on each other?
2. What are some animals which are now extinct? What were the causes of their extinction?
3. Name some animals which are near-extinct.
4. What measures are being taken to prevent extinction of wildlife?
5. Is wildlife a renewable resource?
6. Discuss: Homes for wildlife - trees, bushes, grass, and other natural vegetation make the best homes for many animals. Clear streams and lakes are best for fish and waterfowl.
7. Discuss: Food for wildlife - seeds, plants, fruits, berries, insects, and animals found in nature furnish most of the fool; some food may be supplied by us during winter months. Water plants, small fish, and insects furnish food for fish and most waterfowl.
8. Discuss: Protection of fish and wildlife by hunting and fishing laws, and wildlife refuges.
9. How does the wildlife resource affect the community life of nearby towns?
10. How can city people conserve wildlife?
11. How does wildlife help trees, plants, and the soil?
12. Wild birds and animals store food for winter in what ways?
13. What would happen to man if all wildlife became extinct?

14. Are there any organizations, clubs, government offices, etc., that are trying to protect wildlife?

15. In our own area around Kemmerer, can you name any wildlife which might possibly become extinct in the near future? If so, what are the causes, and how can we prevent their extinction?

16. Thirty percent of the American public hunts or fishes for recreation. What businesses would be affected by loss of wildlife?

ACTIVITIES

1. Discussion of "Conservation on the School Grounds." Such things as proper use of water fountains, protecting trees and shrubs, being careful with the lawns, not wasting paper, keeping the building and grounds clean.

2. Listing of conservation practices the students read about in newspapers and magazines, and those they have seen themselves

3. Make charts of soil erosion and show how soil erosion can be controlled

4. Discussion of farming practices "Then and Now "

5. Prepare a report concerning the recent oil slicks that have occurred in the ocean and lakes; discuss ways in which they may be either prevented or taken care of. What effects have these oil slicks had on the wildlife and the soil nearby?

6. Types of soils - To show the difference in soil particles, secure samples of soil from as many places as possible and place in glass jars. Try to get samples of sandy soil, a loam soil, a clay soil, a soil rich in decayed matter or humus. Have the pupils study the samples and examine bits from each sample with a magnifying glass. Put several handfuls of each type in a half-gallon jar; fill the jar with water and then thoroughly shake up the soil in the water. Let the jar stand for several hours. The heaviest particles will settle out first and the lightest last. The layers in the jar after settling will be in the order of the weight of the soil particles. Siphon the water from the jar with a tube. Next examine a small sample from each of the layers with a magnifying glass.

7. The effects of soil on growing things - Get samples of a fertile soil from a garden, from a sandy place, from the woods, from a clay bank, etc. Place the different samples in several jars. Plant seeds in each type of soil and give each the same amount of water. Observe in which type of soil the seeds sprout first. After the plants have started to grow, observe the soil sample in which they grow best.

8. To show that soil may contain water - Place some soil in a thin glass dish and heat it CAUTIOUSLY over a small flame. Cover the jar, and water will be observed to condense on the cool sides.

9. To study the difference in fertility between topsoil and subsoil - Secure a sample of good topsoil from a flower or truck garden. Secure another sample of soil from a depth of about 16 inches. Place the samples in different flower pots and plant seeds in each. Keep the amount of water, the temperature and the light equal on each sample. See which soil produces healthier plants.

10. To show the presence of nodules of nitrogen-fixing bacteria on the roots of legumes (plants) - Carefully spade up some leguminous plant such as clover, alfalfa, soy-beans, cow peas, etc. Remove the soil from the roots by washing with water. Observe the little white bumps or "nodules" on the roots. Nitrogen-fixing bacteria are inside these nodules. These bacteria remove nitrogen from the air and fix it in a form that enables plants to get it from the soil.

11. Erosion on barren and grass-covered soil - Using a large plastic tray, insert a piece of wood to divide the tray into two compartments. Put a plastic liner in each compartment to prevent water flowing from one into the other. Fill one side of the tray with a chunk of sod (grass-covered soil), and the other side with barren soil. Raise one end of the tray to allow gravity to draw the running water downhill. Have class observe the water as it runs downhill, and that the running water flowing over the grass-covered soil is slowed down so that the water draws into the soil. Have the class compare the amount of water that actually collects at the lower end of the box. It will be seen that water running over the barren soil erodes the surface much more than water traveling over the grass-covered soil. This will be noted by comparing the amount of sediment in each half of the container. The water on the grass-covered side will also appear cleaner than the water which flowed over the barren soil.

12. Effects of running water on soil - Running water can exert sufficient force to move particles of soil, and sometimes very large rocks. Rapidly moving water will carry more sediment than slow moving water. To demonstrate the action of running water, use a mound of soil ten inches high in a large tray. Trickle water over the top of the mound very slowly, and have class note what is happening to the surface of the land. Small particles of soil held loosely on the earth's surface will be dislodged and carried away. Increase the flow of water over the mound. Compare the amount of wearing away of the land when water is running swiftly. Direct class's attention to the soil collecting at the bottom of the hill. Sometimes the loose soil is removed and a hard rock surface is exposed. Water will run over the rock and drop below to the soft earth. In doing so, a waterfall is formed. Look for the formation of any tiny waterfalls along side the hill.

13. Field trip to KOLab - Observe: Erosion, overgrazing, different types of soil, role of sagebrush in conservation.

14. Organize a field trip to observe wildlife; draw pictures of what is seen.

15. Interview early settlers and ask them to compare your community now with the way they first found it - extent of erosion, lowering or raising of the groundwater table, flood damage, muddy streams, decrease or increase of fish and wildlife. Write an account of your interview; give to local newspaper to publish.

16. Make field trips to game preserves, fish hatcheries, wildlife refuges, and tree nurseries.

17. Build bird feeders and houses for songbirds.

18. Make a list of plants: those grown for food and erosion control on farms and in gardens and orchards.

19. Make a miniature farm in the classroom, including buildings and soil, and show conservation practices.

20. Field trips to: Cutover or burned-over forest, reservior filled with silt, muddy streams.

21. Make a trip to an industrial plant and note which natural resources it uses and how it uses them. Observe any waste. Does the factory dump waste products into a stream and pollute its waters? What effect does water pollution have on plant and animal life? Find out what the community does about pollution and report to class.

22. Plant grass or trees on eroding land in the schoolyard, KOLab or at home.

23. Organize a Conservation Club. Choose a club flower or design an emblem for a pin.

24. Obtain land-capability maps of some farms from nearby or local soil conservation districts. Study the maps and then take them to the farms where they were made and compare the way the farmer is using the land with the land capability as shown on the map.

25. Visit a farm machinery or implement store or factory, and learn how certain machinery helps in conserving soil, water,etc.

26. While on a field trip, make a map of a farm or landscape, showing land suitable for growing crops; land suitable for forests, brush, or wildlife areas; and land suitable for pastures.

REFERENCES

Soil Conservation Service State Offices

Wyoming
Tip Top Bldg.
345 E. 2nd Street
P. O. Box 340
Casper, Wyoming 82601

Smoky Bear Junior Forest Ranger Kit:

United States Dept. of Agriculture
Smokey Bear Junior Forest Ranger Kit
Washington, D. C. 20250

For a free copy of a film catalog:

A Critical Index of Films & Filmstrips
in Conservation
The Conservation Foundation Audio-Visual
Center
30 E. 40th Street
New York, New York 10016
(Revised 1965, 78 pages)

Filmstrips & Slide Series of the U. S.
Department of Agriculture, AH-222
Photographic Division
Office of Information
U.S. Department of Agriculture
Washington, D. C. 20250

For free Soil Conservation Service Publication:

Soil Conservation Service
U. S. Department of Agriculture
Washington, D. C. 20250

The above address includes free copies of the following topics:

Teaching Soil & Water Conservation
A Classroom and Field Guide

Conquest of the Land Through 7,000 years

Early American Soil Conservationists

Facts About Wind Erosion and Dust on the Great Plains

Grass Makes Its Own Food

Know Your Soil

Making Land Produce Useful Wildlife

Snow Surveys

More Wildlife Through Soil and Water Conservation

Soil Conservation at Home

Soil Conservation Districts: What They Are, How They Work, How SCS Helps Them

Soil Erosion, the Work of Uncontrolled Water

Soil That Went to Town

That Land Down There

Tree and Soil

Water - and the Land, Facts About Our Water Problem

Water Facts: Sources, Supply, Needs, Uses, Lossess, Floods, Conservation

Water Intake by Soil: Experiments for High School Students

What Is a Farm Conservation Plan?

What is a Ranch Conservation Plan?

What is a Watershed?

Windbreaks in Conservation Farming

BOOKS

Science Curriculum Guide for Elementary Grades LMC
Conservation Education Unit Outlines for Teachers 4-6 KOLab
Aids for Nature Interpretation LMC
Field Study Manual for Outdoor Learning KOLab
Coordinated Resources Use Through Multiple-use Management KOLab
Conservation Tools for Educators LMC
Teachers Conservation Kit LMC
Golden Bookshelf of Natural History Animals
The Web of Nature
The Community of Living Things in Field and Meadow
Understanding Ecology

Teachers Editions-Activities and Experiments

Source Book for Science Teaching UNESCO LMC
Science Activities for Elementary Grades LMC
Science for Today and Tomorrow Grade 6 LMC
Investigating Science with Children - Vol. 2 The Earth LMC

Elementary School Science Bulletins

No. 56 October, 1960
No. 69 March, 1962
No. 54 April, 1960

Audobon Nature Bulletins

Conservation for Everybody 7
What Good are Insects? 46
Wildlife Preserves 47

Filmstrips

FS151	Conservation, How Long Will it Last?
FS155	How Man Conserves the Soil
FS156	How Man Has Used the Soil
FS157	Water and the Soil
FS705 to FS711	Conserving Our Natural Resources Series: What is Conservation?

Pamphlets

The Meaning of Conservation by Roland C. Clement
Conservation of Natural Resources, 4-H Agricultural Extension Service
Soil and Water Conservation Manual - Unit I
Conservation Soil and Water Project

Teaching Conservation Through Outdoor Education Areas
Outdoor Recreation Potential Wyoming
Journal of Soil and Water Conservation
Manual of Outdoor Conservation Education
Guarding Our Heritage
Wyoming's Natural Resources and Their Management
Conservation (a picture discussion portfolio kit)

KOLab Resource Units

Soil Chemistry Advanced
Soil Chemistry Elementary
Soil Texture

UNIT 2

GEOLOGY - ROCKS AND MINERALS

THINGS TO FIND OUT

1. What forces change and shape earth's surface?
2. What forces wear away earth's surface?
3. How was soil formed?
4. What is a rock?
5. Are rocks found everywhere?
6. What is a mineral?
7. Where can you find minerals?
8. What is an active volcano?
9. What is an igneous rock and where is it found?
10. What is a quarry?
11. Does the earth wear out?
12. Are there rocks under H_2O?
13. How are rocks made?
14. Why do rocks have different shapes and colors?
15. Where do metamorphic rocks come from?
16. What is a crystal and how can you make one?
17. Can we eat minerals?
18. What are rock forming minerals?
19. How do we begin to identify rocks and minerals?
20. How can we tell how hard rock or mineral is?
21. What is a fossil?
22. Where are fossils found?
23. What is pumice? Coal?
24. What is ice?

ACTIVITIES

1. Make crystals

Pg. 29 Rocks and Minerals, How and Why Wonder Book
Pg. 32 Rocks and Minerals, How and Why Wonder Book
(Kemmerer Elementary)

2. Mineral Food Party - Bring eggs, meat, cheese, salt, fish, beans, and peas

3. Scratch rocks
   Use fingernail, penny, pocketknife or other rocks

4. Look through magnifying glass at sand. Note sand is actually tine rocks

5. Study uses of rocks in home. Each child bring, eg., from home - chalk, salt, scouring powder

6. Make individual rock collections. Use Elmer's glue on tagboard or egg cartons. Primary grades may classify according to what they like about rock. Eg., color, shape, size, texture, hardness. Older children may wish to classify by type of rock such as igneous, etc.

7. Make sandpaper with glue and sand.

8. Jim Groutage has an arrowhead collection to display.

9. Visit fossilfish beds.

10. Trip to the Green River to find own fossils.

11. Make fossil with hand print, shells, etc.

12. Trip to KOLab. Observe soil from different sections of KOLab with magnifying glass.

13. Note man-made rock, concrete, and the reaction it has to the sun. Compare to expanding and contracting of rocks.

14. Primary children may enjoy rubbing rocks against something. This simulates the effect of the rain on a rock.

15. Simulate volcano with clay. Put bottle in center containing vinegar. Add soda.

16. Roll out modeling clay of different colors into sheets about 1/4 of an inch thick. Pile sheets on top of each other. Cut down through pile.

17. Do rock experiments on Pgs. 9-15, Rocks and How We Use Them - Pine, Levine, Kemmerer Elementary. (Helps in identification of types of rock.)

18. Make artificial sedimentary rock.

    a. Put sand in small carboard container. Add a little plaster of paris and mix well. Add a little water, stir and allow to dry. Artificial sandstones will be formed.

b. Press wet clay together and allow to dry. Rock like material similar to shale will be formed. (Use pottery clay)

19. Test rocks for cleavage. Strike rocks until they break. Some will split along one or more planes and form flat smooth surfaces. Others form rough or splintery surfaces or smooth curved surfaces.

20. Examine original color of rock by breaking them and looking at the inside.

21. Make artificial rocks with plaster of paris or cement.

22. Weigh rocks of same size to see if they weigh the same.

23. Folding demonstration:

    Fold three different colored towels until they are long and narrow and then place one on top of the other to represent layers or rocks. Place one hand near end of towels and push sideways toward middle. Produces wavelike folds to simulate mountains and valleys.

24. Make rock pictures, rock figures, paint rocks.

25. Find and display pictures of different geological formation: plains, plateaus, mountains, valleys, etc.

26. Find how geysers erupt by placing a short-stemmed funnel in a pyrex beaker and add water until bowl of funnel is covered and the water is level with the beginning of the stem. Heat beaker on hot plate. When water begins to boil, the bubbles of steam expand and rise, pushing the water up the stem and making it spout like a geyser.

27. Freezing water cracks rocks. Fill a 2 or 4 ounce medicine bottle with water. Freeze and wrap with towel, it should break.

28. Heat shale on flame and plunge into cold water. It should break.

29. Make mural of plants and animals that lived in different geological areas.

30. Mrs. Ulrich will come and show slides of fossils.

31. Find uses of rocks.

REFERENCES

Books

Rocks and Minerals
How and Why Wonder Book, Rocks and Minerals
Stories Read From the Rocks, Parker
Science for the Elementary School, Victor
Earth Through the Ages, Carona
Man's home, The Earth, Chandler
Your Changing Earth, Ruchlis
Mountains, Waller
Rocks and How We Use Them, Pine and Levine
Gems and Rare Metals, Waller
Our Earth, How and Why Wonder Book
Rocks and Minerals, Golden Nature Guide
Fossils, Golden Nature Guide

Filmstrips

FS150 How Soil is Formed 3-6
FS154 Minerals and the Soil 3-6
FS460 The Face of Land 2-6
FS521 How We Think Our Earth Came To Be 2-6
FS522 Our Earth is Changing 2-6
FS523 How Rocks are Formed 2-6
FS524 Story of Earth We Find in Rocks 2-6
FS608 R286 How Fossils are Formed 2-6
FS609 R287 Collecting and Interpreting Fossils 2-6
FS610 R288 Fossils and Relative Ages of 2-6
FS611 R289 Fossils and Prehistoric Environment 2-6
FS612 R290 Fossils and Organic Change 2-6
FS613 R291 Measuring Shape of Land 2-6
FS615 R293 Measuring Movements of Earth's Crust 2-6
FS616 R294 Making Geological Map 2-6
FS618 R296 Gravity 2-6
FS619 R297 Investigating a Glacier 2-6
FS620 R298 How Glaciers Shape Valleys 2-6
FS1104 Rocky Mountains 1-6
FS1106 Volcanos and Action 1-6
FS1105 Glaciers and Work 1-6
FS1107 Hot Springs and Geysers 1-6

Land Form Models REA 3 1-6

Volcanoes Pictures Series REA 15 (could not locate)

Transparencies

OHT 5 Geology and Earth Science

Pamphlets

Earth Science K-6 LMC

The Earth National Science Teachers Association

UNIT 3

SOIL

QUESTIONS

1. What is soil?
2. What is good soil?
3. What is poor soil?
4. Why do we test soil?
5. What are some of the animals that live in soil?
6. What is topsoil?
7. What causes erosion? How is soil formed?
8. How long does it take to make an inch of topsoil?
9. What does sandy soil contain?
10. What does clay soil contain?
11. What does loam soil contain?

TERMS

Humus - composed of decayed organic matter from living things.

PH - a measurement of acidity; the lower the PH the greater the acidity.

Erosion - refers to the movement of soil and debris from one place to another.

Soil - small particles of rock that covers most of the surface of the earth combined with decaying rock and decaying vegetable matter.

Mantle rock - the lower layer of rock which forces of weathering continue to act upon to form soil.

Top soil - the first eight inches of soil

Subsoil - the soil underneath the topsoil which is thicker, has little or no humus and a lot of pebble in it.

Sandy soil - has mostly sand with a little clay and almost no humus.

Clay soil - has mostly clay in it with a little sand and humus and is sticky when wet and as hard as rock when dry.

Loam soil - has proper amounts of gravel, sand and clay in it, together with lots of humus.

Splash erosion - soil that is washed away by a splash of water or raindrops.

Sheet erosion - water running off in broad sheets carrying soil with it.

ACTIVITIES

1. Secure samples of soil from as many places as possible and place in glass jar; sandy, loam, clay or humus.
2. Fill a jar half full of water. Add some handfuls of soil and then shake up the soil in the water. Let the jars stand. The heaviest particles will settle first.
3. Look at samples of soil under magnifying glass.
4. Place some soil in a glass jar and slowly pour water over it. Watch the air bubbles rise through the water from the soil.
5. Plant seeds in different types of soil to see in which soil the plants grow best.
6. Pour water over a tray of soil to see the effect of water on the soil.
7. Pour water over a tray and try sloping the tray at different angles to see the effects of the water.

8. Use a medicine dropper with water and release it over a saucer or jar lid filled with soil on a piece of white paper.

9. Take a field trip to study erosion.

10. Find places of erosion on the school yard and decide upon means for preventing the erosion.

11. Measure the water content of loamy soil. p. 28, Earth.

12. Measuring the Humus Content of Loamy Soil p. 29, The Earth, Investigating Science with Children, Vol. 2

13. Observing the Sand in Loamy Soil p. 30, The Earth

14. Measuring the Depth of Loamy Soil p. 31, The Earth

15. Making a Soil Profile p. 28, The Earth

16. Testing Soils for PH p. 34, The Earth

17. Changing the PH of a Soil p. 35, The Earth

18. Examining Animal Life in Soil p. 36, The Earth

19. Examining Plant Life in Soils p. 36, The Earth

20. Comparing Air Temperature and Ground Temperature p. 73, The Earth

21. Comparing Water, Soil and Air Temperature p. 74, The Earth

22. Measuring the Water Loss from Soil p. 75, The Earth

23. Creating a Small Landslide p. 83, The Earth

24. Making an Erosion Table p. 84, The Earth

25. Demonstrate the Effect of Plants upon Erosion p. 85, The Earth.

26. Make a Splash Stick p. 86, The Earth.

27. Observing How Wind Changes the Appearance of the Soil p. 87, The Earth

28. Children feel the texture of the different soil samples

29. Plant beans in a pot of humus soil and some in a pot of course sand.

30. Formation of a pond or lake p. 188, Science Activities for the Elementary Grades

31. Grow plants in soil, and grow plants in distilled water and no soil is used.

32. Activity on how to keep soil from blowing away Lesson No. 30, Science Curriculum Guide for Elementary Grades

33. Put earthworms in glass jar filled with soil. Place white sand on top. Add 1/4 cup of water. Put corn meal on top of white sand. Put jar in large paper sack. Observe once a day.

34. Place a pulverized rock in a glass jar. Place sand in a glass jar and good humus soil in a glass jar. Place corn seeds in each jar.

35. Find the water-holding capacity of different soils p. 204, The Book of Popular Science.

36. Take a glass and drop a handful of soil inside. See what makes up the soil.

37. Have two plants. Keep the soil broken up around one plant and do not touch the soil around the other plant.

REFERENCES

Bulletins

Conservation for Everybody, Audubon Nature Bulletins
Plants as Makers of Soil, Audubon Nature Bulletins

Filmstrips

FS150	How Soil is Formed
FS151	Conservation, How Long Will It Last?
FS152	Animal Life and the Soil
FS153	Plant Life and the Soil
FS154	Minerals in the Soil
FS155	How Man Conserves the Soil
FS156	How Man Has Used the Soil
FS157	Water and the Soil
FS617	Measuring Underground Temperatures with R295
FS706	Saving Our Soil
FS708	Improving Our Grasslands

Teacher's Resources

The Earth, Vol. 2, National Science Teachers Association
Science Activities for the Elementary Grades, Syrocki, J.
Science Curriculum Guide for Elementary Grades, Englewood Public Schools.

The Book of Popular Science, Vol. 2-4-5-6-10
Earth - Through the Ages 525c, Garona, Phillip B.
Man's Home - The Earth 550c
Your Changing Earth, 550, Ruthlis, Hy.
Science for the Elementary School, Victor, Edward
Lamotte Soil Handbook, KOLab RU. 21

UNIT 4

SEEDS

OBJECTIVES

1. Seeds are a good means of identifying plants; try to identify at least 10 different seeds.
2. Practice in observation, experimenting, recording of data
3. Conditions for seed germination

TERMS

Cutting - Pieces of leaves or stems cut off a mature plant to grow new plants

Pigment - Substance giving color to a leaf

Pollen - Powder mass on a flower used in fertilization

Germinate - To grow and develop

Embryo - Baby plant

Viable - Seeds that are living and able to grow

Bulbs - Underground Buds

Stamen - Male part of a plant

Pistil - Female part of a plant

Ovary - Part of a plant which contains the seeds

Chlorophyll - Green substance in green plants

Stomates - Tiny breathing pores in leaves

Petal - Colored part of a plant

THINGS TO FIND OUT

1. How are plants different from animals?
2. What is a seed?
3. What is the name given to the outside covering of a seed?
4. What are the steps in which a seed develops into a plant?
5. Another name for a baby plant is. . .?
6. What are the 3 conditions required for germination (growth) of a seed?
7. How would one go about planting a seed?
8. Name some minerals which enrich the soil.
9. What are two methods of enriching the soil?
10. What is the difference between a compound leaf and a simple leaf?
11. Which plants can make their own food?
12. What is this process of food-making in green plants called?
13. What must plants have in order to make their own food?
14. How do plants breathe?
15. What is the name of the sugary fluid inside flowers which attract insects?
16. What are some different pigments in leaves?
17. Why do leaves fall?
18. What is the purpose of the stem?
19. The part of a plant which absorbs water is. . .?
20. Will plants grow upside down?

ACTIVITIES

1. Make a list of all vegetables we usually eat. Place these in categories according to what part of the plant is eaten (leaves, stem, seeds, flowers, roots etc.)

2. With 3 different sets of beans, test seeds in cold, lukewarm, and hot water, using the fourth set of dry beans as the control. Test the different reaction in light, temperature, and absorption of water; record.

3. Viability Experiment - Put exactly 100 lentil seeds in a jar and mark the level of seeds on the glass before you water them; then, water and leave in a warm room overnight. Next morning pour off any water the seeds haven't absorbed, and mark the jar to show the new level. Make a record in your notebook of how much the seeds swelled. For the next two or three days keep soaked seeds moist and covered. When you see that the seeds are sprouting, spread them all out on a large sheet of paper and count exactly how many have started to grow. Suppose that you find 80 out of 100 have sprouted. For this batch of seeds, the percentage of viability is 80%. On packets of seeds that you buy for planting, the percent of viability is stated on the envelope.

4. Roots - Fill a low bowl with pebbles; cut off and plant the top inch of a fresh carrot, beet, or radish. Push the cut-ends down into the pebbles, making sure that the roots do not touch one another. Add a piece of charcoal to prevent the water from giving off an odor. Set you "root garden" in a very sunny window and observe daily, adding water when needed. The food stored in the carrot will nourish new leaves which will grow in two or three weeks.

5. Soil Mixtures - Using radish, marigold, morning glory or bean seeds, plant in different soil mixtures such as vermiculite, clay, builder's sand, or humus. Use cut-off milk cartons for the pot, punching a hole in the bottom for drainage, and set the container on a dish. The larger the seed, the deeper it should be buried in the soil. Water regularly.

6. Collect leaves from different trees, mount, and label.

7. Try to grow a tomato plant upside down. Water the soil, cover the top of the pot with aluminum foil which must be tied down securely with a string; put the pot near a well-lighted window. Within 24 hours, you will see that the stems will turn at the tip and grow upward against gravity.

8. Plants breathe - When your tomato or marigold plant is about three inches tall, cover the soil in the pot with heavy waxed paper or aluminum foil so that none of the moisture can escape. Invert a glass tumbler over the pot so that you can make a little greenhouse around the plant. Fasten the glass so it will not fall over, and set the plant in a sunny window. As your "control," set up a second pot exactly the same way but without any plant. The moisture collects in drops on the side of the glass jar covering the plant, but not on the other jar. The plant is giving out this moisture through the stomates in its leaves.

9. Cuttings - With a fully grown geranium or begonia, cut a stem leaving three or four leaves on it and cutting about two inches below the lowest leaf. Plant cutting in builder's sand or dry vermiculite, packing the area around the cutting. Water and set in a shady place. Keep damp, but not wet. Set in the sun after two or three days. If cutting starts to wilt, shade it again for another day. In about two to four weeks, depending on the season of the year you are planting, the cutting should be rooted and ready for potting in soil, especially when new leaves appear at the growing tip. Remove the cutting from the pot by lifting it from the pot with the sand clinging to the roots. Add soil when needed.

10. Flower collection - Collect and press flowers; label

11. Collect state flower

12. Seed collection, attractively arranged

13. Spatter prints producing leaf silhouettes: Pin leaf to paper, then dip an old toothbrush into poster paint and point the brush, bristly side up, toward you with a stick six inches long. When you have a thick cluster of spots all around the border of the leaf, carefully lift the leaf from the paper.

14. Aqua-terrarium - Suggested plants are: mosses, ferns, violets, wintergreen. Populate with animals such as a salamander, frog, toad, mud puppy, tadpole, etc.

TEACHER INFORMATION

1. A plant consists of a leaf, stem and root.

2. Functions of the leaf:

    a. photosynthesis (food making)

b. breathing

c. transpiration

3. Functions of the root:

   a. absorb water and mineral and air from the soil

   b. anchor the plant (prevents erosion by holding the soil particles together)

   c. Keep the moisture in the soil surrounding the plant

4. Functions of the stem:

   a. support the leaves and flowers

   b. store food and water

   c. conduct liquids which nourish the plant

5. Three conditions for germination of a plant:

   a. moisture

   b. light

   c. temperature

6. Seed dispersal:

   a. wind

   b. water

   c. animals

   d. animal droppings

MATERIALS

SEEDS
GLASS JARS
PEAT POTS
VERMICULITE
PLANT NUTRIENT
MAGNIFYING GLASS
BLOTTERS or PAPER TOWELS
PENKNIFE
MEDICINE DROPPERS
COBALT CHLORIDE PAPER
WOODEN PLANT LABELS

PAPER CLIPS
FLOWER POTS
MILK CARTONS
RUBBER BANDS
SANDY SOIL
CHARCOAL
PEBBLES
SEED GERMINATION KIT (KOLab)
MICROSCOPES

REFERENCES

MICRO-VIEWERS

Rea 51 Cells of plants (30 copies)

Rea 56 Plant Mitosis (29 copies)

Rea 57 Photosynthesis (30 copies)

TRANSPARENCIES

The Story of Trees (ele.) OHT25 (orig.)

Plant Structure Part I OH57 (orig.)

Plant Structure Part II OHT58 (orig.)

PAMPHLETS

Growing Seeds Pam. TA 63

FILM LOOPS

FL 47 Plant Growth - Graphing Grades 5-6
FL 48 Bean Sprouts Grades 4-5-6
FL 70 Mitosis (in Endosperm of Haemanthus Katherine) Grades 5-6

FILM STRIPS

FS 153 Plant Life and the Soil Grades 4-5-6
FS 719-724 Plant Life Series Grades 4-5-6
FS 797 Plants Get Ready for Winter Grades K-3
FS 798 Seeds Travel Grades K-3
FS 2358-1364 Growing Things K-3

BOOKS
GOLDEN NATURE SERIES:

Non-Flowering Plants
Flowers
Trees

TEACHERS EDITIONS

SCIENCE ACTIVITIES FOR THE ELEMENTARY GRADES by
B. JOHN SYROCKI

SCIENCE CURRICULUM FOR ELEMENTARY GRADES (KOLab)
ACTIVITES and EXPERIMENTS

BOOKS CONT.

Understanding Ecology

Naming Living Things: The Grouping of Plants and Animals

Deserts

Trees and Their Story

The Community of Living Things in Field and Meadow

The Amazing Seeds

UNIT 5

TREES

TERMS

1. Deciduous - trees with broad, flat leaves, which they lose each year
2. Coniferous - trees which produce woody cones, evergreen trees mostly
3. Bark - outer covering of the trunk of a tree
4. Pith - center of the trunk of a tree
5. Simple leaf - one in which the blade is all in one piece
6. Compound leaf - leaf in which the blade is divided into three or more separate parts

THINGS TO FIND OUT

1. What is a tree?
2. What are the two major groups of trees?
3. What trees grow well in this climate?
4. What are the three main parts of a tree?
5. What are simple and compound leaves?
6. What do we mean by entire, toothed, and lobed leaves?
7. Why do leaves change color in the fall?

8. When the first settlers arrived in this country, the land was heavily covered with forests. What percentage of the original forests remain? What happened to the forests?

9. Why are trees an important natural resource?

10. How do trees protect us from excess noise?

11. Can trees be nuisances in any way? How?

12. When studying the rings of a tree trunk, why are some rings broader than others?

13. How do winds affect a tree?

14. What is a "wolf" tree?

15. How can the age of a tree be estimated without cutting down the tree? (See Science You Can Use, Stone and Stephenson, p. 25.)

16. What is the work of the U. S. Forest Service?

17. How does the Forest Service try to control insects?

18. What do we mean by hard and soft wood?

19. What are some products of trees?

20. What would the world be like if all the trees were destroyed?

21. How do animals depend on trees?

22. What are the three distinct regions of the trunk of a tree? (Bark, wood, pith)

ACTIVITIES

1. Plant a tree. Keep a log of the changes in growth.

2. Take a walk and see how many kinds of trees you can name.

3. Take a field trip to the forest and study the trees.

4. Draw a map showing the six forest regions of the U.S. Color the areas using a different color for each. Print the names of the trees that grow in each of the forests.

5. Make a collection of tree twigs. Cut each one so that the inner part of the twig may be seen. Mount

your collection, arranging twigs so that all the cone-bearers are together, all the nut trees together, etc. Label each twig, giving the name of the tree from which it came and place where it was found.

6. Make a collection of seeds from trees in your neighborhood. Label and arrange in groups.

7. Find a stump and count the rings in it. Each ring represents one year of growth. By counting rings, you can find out how old the tree was when it was cut down.

8. Make a list of insects that are harmful to trees. Try to find a tree which has been attacked by insects.

9. Make a study of insect control in Bridger National Forest.

10. Make a study of the effects of pesticides on insects, trees, and other forest life.

11. Study the different kinds of fungi that attack trees. How are they controlled?

12. Choose one tree to study all year long. Describe the changes month by month.

13. Gather pictures of trees of different shapes. Make a bulletin board or scrap book of them.

14. A highway has been proposed to cross the wilderness areas of Wyoming. Have a debate on the pros and cons of this highway.

15. Make a collection of leaves. Press and mount on cardboard. Turn some over to show reverse side. Cover with cellophane and label.

16. Make a collection of seeds and fruits. Store in small boxes or jars.

17. Locate historic trees in your community that may be famous for their age, size, or historic events that took place nearby.

18. Collect examples of different kinds of lumber. Study the grain. From what trees did they come? Are they hard or soft wood?

19. Study maple-sugaring. Where does the sugar come from?

20. Find stories about the giant sequoias of California, "General Sherman".

21. Look for a tree that has fallen over. Study the root system.

22. Make a collection of needles. Label.

23. Study the effects of air pollution on trees.

24. Make a tree map of the block in which you live.

25. Make a cast of a leaf in this way: Find a cardboard box large enough so that the leaf can lie flat in it. Put a layer of modeling clay in the bottom. Press the leaf into the clay. Remove the leaf. Mix a cupful of plaster of paris with enough water to make a thick paste. Pour paste into box. Let stand until hard. Then take out the block of plaster of paris. The block should have a cast of the leaf on the underside. You may paint cast with watercolor.

26. Make a blueprint of a leaf by placing a leaf on blueprint paper and leaving it in the sun.

27. Make rubbings of leaves with pencil or crayon.

REFERENCES

Books

Science for the Elementary School, Victor Edward
580W Plants, Waller, Leslie
580 Forest and Woodland, Collins, Stephen
E582P Leaves, Parker, Bertha
582P Trees, Parker, Bertha
582S Trees and Their Story, Sterling D.
Trees, Golden Nature Guide
The Rocky Mountains, Golden Regional Guide
Wise Use of Wyoming Resources, Webb, Harold V.
Science You Can Use, Stone and Stephenson
Mountains, Waller, Leslie
The Wonders of Nature, Coe, Geoffrey and others
Plants with Seeds, Wood, Dorothy
Classroom Demonstrations of Wood Properties, U.S. Department of Agriculture, Forest Service

Pamphlets

Turtox Service Leaflets Pam. T.A. 161, No. 3, Preserving Botanical Specimens

Audubon Nature Bulletins Pam. T.A. 162, No. 40, Things To Do In Nature (How to make prints and plaster coats.)

Filmstrips

FS1359	Trees Grow K-1-2
FS 151	Conservation, How Long Will It Last? 4-5-6
FS 709	Using Our Forests Wisely 4-5-6
FS 719	
-	Plant Life Series 4-5-6
FS 724	
FS1104	The Rock Mountains 3-6
FS1111	Protecting Our Forests from Fire 3-6
FS1117	A Walk in the Woods K-2

Transparencies

OHT25	The Story of Trees 2-6
OHT322	Conservation K-6 (Good)
REA 68	Bio. Plastic Plant Kingdom Collection

Slides

SL1832-1859	Tree Fruits
SL1860-1880	Pine Life History
SL2024-2062	How To Know the Conifers
REA 16	Map of Wyoming (3 dimensional plastic)

UNIT 6

PLANTS IN THEIR HABITATS

Different kinds of plants grow in different environments. This unit will deal with investigating the plant growth in the desert, Tundra, forest and jungle. Your class may like to choose which area it would like to study first, or groups may like to work on the different areas and share their information with the class.

TUNDRA

1. The term tundra is derived from a Finnish word which refers to "barren land". This term has come to refer to the treeless zone of the Arctic. It also applies to the type of vegetation found beyond the timberline.

2. Tundra zone lies at high latitiudes.

3. Soil of the tundra is shallow, for it lies over a permanently frozen substratum the permafrost. It is very gravelly soil.

4. Tundra plants

    a. lichens

    b. masses

    c. grasses and grass-like herbs

    d. cushion plants

    e. low shrubs

ACTIVITIES

1. Take a field trip above the timberline

2. After presenting some information about the tundra, have the children draw a picture of what they imagine it might look like.

3. Show the film strip No. FS 332 Arctic Tundra (omit captions for primary grades)

4. Things to look for on the field trip:

   a. type of soil

   b. temperature

   c. humidity or water

   d. lichens, mosses, grasses, low shrubs

   e. Is any of the vegetation used as a food by man or animals?

5. Record the facts discovered about the tundra like area and its plant life.

6. Compare the film strip of the Arctic Tundra to the field trip above the timberline.

7. See filmstrip FS1108 Life at the Timberline.

8. Collect specimens of plants and soil found above the timberline.

9. Make a model of the tundra with plants and soil collection. Regulate temperature if possible.

DESERT

As a class, record all we know about the desert before we begin this section of the unit.

Did you answer the following questions?

1. Is it hot or cold?

2. Is the temperature the same in the day as it is at night?

3. Is it wet or dry?

4. Do any animals live there?

5. Do people live there?

6. Do plants live there?

7. Do all deserts look the same?

8. Do all deserts have the same things living in them?

If we can't answer all of these questions lets do some investigating.

ACTIVITIES

(Individual or class)

1. Read about the desert in reference books. Have these available in room or library, using these suggested areas;
    a. Deserts in our area
    b. Deserts in the U.S.
    c. Deserts of the world
2. Display pictures of deserts and discuss: plant life, soil and water found in them. (National Geographic)
3. Collect pictures of deserts and its life. Use for a bulletin board.
4. Field trip to desert-like area in Wyoming
    a. collect plant specimens
    b. record environmental conditions
    c. count how many different types of vegetation can be found in a small area
    d. does the vegetation have any use for man, for animals?
    e. compare leaf, root and stem of desert plants with same of tundra type vegetation. Why are they different?
    f. Collect prickly pear for experiment
5. Place prickly pear in large jars with desert soil. Water with varying amounts; observe reaction. Record data.

6. Compare different cacti
    a. root systems
    b. water storage
    c. flowers
    d. protection
    e. seeds
    f. edibility
    g. use for animals
7. View film strips (see bibliography). Are any of these desert plants found in our area?
8. Make a desert terrarium including:
    a. soil
    b. plants
    c. miniature desert animals (possibly modeled in clay)
    d. regulate climate condition if possible
9. Make a chart of desert life. Show how they are interdependent.

FOREST

When we think of the forest we think of trees, the most imposing members of the forest vegetation. Using them as support, growing in their shade, may be more than a thousand kinds of shrubs, vines, herbs, ferns, masses and toadstools.

Let's try to answer the same questions about the forest that we did in the desert portion of this unit.

ACTIVITIES

1. Field trip (use suggested things to look for in desert portion)
2. Collect soil and vegetation for a forest terrarium
3. Experiment with environmental conditions of terrarium. (record results)

4. Do a comparison study of forest, desert, tundra.
    a. kinds of vegetation
    b. amount of vegetation
    c. climatic conditions
5. Make a leaf collection from forest vegetation.
6. Use the REA 16B dimensional map of Wyoming to locate forest areas in Wyoming.
7. Use the transparency OHT 322 Conservation to show how man uses the forest.
8. Use resource books for children reports on forests
    a. where we find them
    b. why they are there
    c. man's use of the forest
    d. useful products of the forest, etc.

JUNGLES

The jungle is a hotter, wetter forest

JUNGLE ACTIVITIES

1. Locate jungle areas on world globe. What kind of climate do they have? Where are they?
2. Collect pictures of the jungle from National Geographics. Study the types of vegetation. Compare with colder forests.
3. Use resource books to answer questions same as No. 6 in forest part of unit.
4. Use film strip FS 333 The Rain Forest. Have each child ask the class a question about the filmstrip.
5. Can you find any jungle type plants in this area indoor or outdoors? Use them in a jungle terrarium.

Activities to do after discovering plants in their habitats:

1. KOLab field trip
    a. what kind of area is this?
    b. are there any forest, tundra, desert or jungle plants here?
    c. what are the climatic conditions, etc.?
2. Use REA 16 map of Wyoming and find different plant habitats.
3. Make a chart of edible vegitation found in the four different habitats.
4. Find edible plants in our area. Make a weed salad.
5. Each child select a plant in his home area to observe for a given period of time. Record observation.
6. From the feel of a leaf, determine what type of climate it is best fitted for. "Memorize" it by odor, if any, and by feel.
7. Field trip activity - How many leaf shapes can you count within your range of vision?
8. Field trip activity - Count all objects in a world at your feet.
9. Go to forest service and get a list of protected plants in our state. Make copies of the laws and distribute to other classes.
10. Are all plants (trees, shrubs) native to your area or were they brought in? Trace the origin of some introduced plants in your area. Make a garden of introduced plants arranging them according to the continent from which they came.
11. Paint a mural of the desert, forest, tundra, jungle.
12. Charade game - Act out a plant for the class and try to identify it.

REFERENCES

Books

R500	The How and Why Wonder Book of the Polar Region
R500L	Life Nature Library, the Plants
R500L	Life Nature Library, the Forest
R500L	Life Nature Library, the Oasis
R500B	The How and Why Wonder Book of the Desert
580	The Community of Living Things in the Desert
R500	Young Readers Edition, The Desert
R500B	The How and Why Wonder Book of Wild Flowers
582P	Trees, Parker
R583	The Community of Living Things in Field and Meadow Audubon Society
R580	Forest and Woodland, Audubon Society
574B	Small Pets from Woods and Fields, M.W. Buck Golden Nature Books

See other 500 Books

Filmstrips

FS1110	The Story of Cacti K-6 (Good)
FS1112	Plants and Animals of the Desert K-6 (Good)
FS 332	Arctic Tundra K-6 (Good)
FS1104	The Rocky Mountains K-6 (Good)
FS1365	Interdependence of Plants and Animals K-6 (Good
FS 333	The Rain Forest K-6 (Good)

Transparencies

OHT 322 Conservation

Nature Bulletins - Audubon Society

No. 5	Club Mosses and Horsetails
8	Ferns
15	An Illustrated Key to Common Lichens
34	Some Adventures with Wild Plants
35	Some Common Mosses
39	The Terrarium, a Miniature Garden under Glass

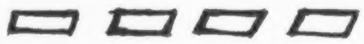
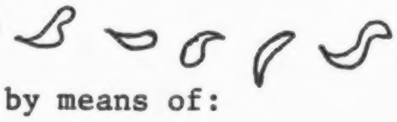
Map

M100	World Thermal Regions and World Vegetation Regions

UNIT 7

BACTERIA - TINY PLANTS

Bacteria are plants with no chlorophyll and no cell wall of cellulose. They exist in several forms

1. Coccous (spheres) °0 °0
2. Bacillus (rod shapes) 
3. Spirillum (curved rods) 

Bacteria may be identified by means of:

1. General structure as observed under the microscope
2. Requirements for growth in the way of food, air and temperature
3. Effects on various media
4. Disease producing power (see terms list)

TERMS

Chlorophyll - the green photosynthetic coloring matter of plants

Cellulose - the chief part of the cell wall of plants

Agar - a type of media bacteria grows well on

Media - food that bacteria will grow on

Bacteria culture - growing bacteria

Bacterial spores - the reproductive body

ACTIVITIES

Bacteria Culture using agar:

1. Obtain agar from high school
2. Melt to liquid state
3. Immediately pour into petri dish
4. Innoculate with bacteria spores (film strip 69 shows procedure for pouring agar plate and innoculating with bacteria by spotting, streaking, etc.)

Using bacteria culture:

1. Investigate different shapes of bacteria using a microscope
2. Discover what environment your bacteria culture grows best in - (light, dark, cool or warm).
3. Use a variety of bacterial cultures and observe the patterns and shapes. (See specific exercises attached to unit).

Preparing a slide with bacteria (slide kit available at high school):

1. Use scrapings from base of teeth (molar).
2. Spread on clean slide with a little saliva (using a toothpick)
3. Fix the dried smear by passing it over a flame several times. (Smear side away).
4. Stain with methylene blue or gentian violet for a minute. (Sube, mercurochrome)
5. Wash in running water, blot dry
6. Mount in balsam (Subs, castor oil)
7. Cover with coverglass
8. Examine under microscope

Other experiments with bacterial slides or cultures:

1. Place food substance (potato, bread or meat) in a jar of water and, after several days, take a bit of scum, transfer to a drop of water on

a slide. Cover. Examine. Swarms of bacteria will be visible.

2. Fresh milk and unrefrigerated day old milk make interesting comparisons. Prepare dry smear, stain.

3. Try stained smears of buttermilk, limburger cheese, pickle juice, scum, etc.

4. Use penicillin tablets with bacterial cultures. Observe reaction.

Other activities:

1. Making cheese

2. Making vinegar, using apple cider. Leave it in a warm place. Bacteria will cause it to ferment.

QUESTIONS

1. What are bacteria?

2. Where can you find bacteria?

3. How does bacteria help make good soil?

4. Why does a doctor wash his hands and sterilize his instruments before treating a patient?

5. Who was Louis Pasteur and what did he do?

6. Who was Robert Koch and what did he do?

7. Who was Anton Van Leeuwenhoek and what did he do?

REFERENCES

Turtox Service Leaflets

No. 36	Practical Microscopy (Good)
50	Elementary Experiments in Bacteriology (Teacher Reference)

Filmstrips

FS223	Microbiology (Includes scientists, types of bacteria, etc.)
FS159	Anton Van Leeuwenhoek (3-6, Color, Good)
FS163	Louis Pasteur (3-6, Color, Good)
FS497	The story of Dr. Lister (2-6, Color, Excellent)

BACTERIOLOGY EXERCISES

Are there any Bacterial Spores Floating in the Air?

1. Place four sterile agar plates on the table and with wax pencil number them one, two, three and four, respectively. Remove the covers from all four plates. At the end of five minutes replace the cover on plate number one. At the end of ten minutes replace the cover plate on number two. At end of fifteen minutes replace the cover plate on number three. At the end of twenty minutes replace the cover plate on number four. Observe growth.

Are there any Bacterial Spores on your Fingers?

2. With the wax marking pencil divide the bottom of the sterile agar plate in four equal quadrants. Each of the four members of your team places his finger on one of the four quadrants. Replace cover and store the plate. Observe growth.

Does Soap and Hot Water Remove Bacteria?

With a wax marking pencil divide the bottom of a sterile agar plate in four equal quadrants, numbering each quadrant one, two, three and four, respectively. Student number one touches his unwashed finger lightly on agar number one. Student number two washes his finger with cold water and touches quadrant number two. Student number three washes his finger with warm water and touches quadrant lightly with his washed finger. Student number four washes his finger carefully with hot water and soap, then touches his finger to quadrant number four. Replace the cover. Observe growth.

Bacteriology of a "Kiss"

4. Remove the cover from a sterile agar plate and touch your lips gently to the agar surface. Replace the cover and store the plate. Observe growth.

To Compare the Bacterial Spore "Fallout" in Different Classrooms:

5. Remove the covers from three sterile agar plates and expose the agar surface to the air in three selected rooms. Expose the plates for ten minutes in each room. Replace the covers and store.

Are there any Bacterial Spores on a pop bottle?

6. Secure an empty pop bottle from a rack of bottles near the coke machine. Take your bottle to the laboratory and set it on the desk in front of you. Remove the cover from a sterile agar plate and invert the agar plate and place it with the agar touching the lip of the pop bottle. Leave it in contact with the bottle for one minute. Remove the plate and replace the cover.

Do flies carry Bacteria?

7. Catch a live fly and remove the wings without injuring the insect. Remove the cover from a sterile agar plate and place the fly on the agar surface. The fly will probably walk about aimlessly. Leave the fly in the dish for several minutes. Remove the fly and replace the cover.

8. Remove the cover from a sterile agar plate and place a copper penny and a five cent piece on the sterile agar surface. Replace the cover.

9. This exercise is exactly like Exercise #1. With a sterile swab, swab your mouth where the teeth meet the gums. If you have a decayed tooth, be sure to swab it several times. Place the swab stick, cotton and all into a tube of agar.

UNIT 8

MOLDS, TINY PLANTS

OBJECTIVES - MOLDS

1. Children working with this unit can become familiar with fundamental principles and basic scientific procedures.

2. Individual achievement

3. Appreciation of molds and other microorganisms in the natural cycle of growth and decay. These objectives were taken from an introduction to the booklet Microgardening in the Classroom Pam TA62 under the heading "Why Study Molds." This booklet is so complete and well written we suggest you use if for a unit on mold. It is applicable to any elementary grade. It lists materials needed, procedures used, etc. As a classroom aid you might like also to ask for Pam TA60, an illustrated handbook of some common molds. (Pictures and identification of molds.)

OTHER REFERENCE

Pam TA162 Audubon Nature Bulletin No. 6 Common Fungi

UNIT 9

BIRDS

OBJECTIVES

1. To use key for identifying birds
2. Learn nesting habits, feeding habits, physical characteristics
3. Learn migration patterns
4. Learn to observe and keep charts
5. Learn to use binoculars

TERMS

Warm-blooded - their body temperature is always the same regardless of the temperature of the air about them.

Molt - birds shed their feathers at least once a year and new feathers replace those that have either fallen out or been broken.

Migrate - move from one home to another during the spring and fall of the year.

Incubation - process of sitting on the eggs and keeping them warm until they hatch.

THINGS TO FIND OUT

1. How do we know that a bird is a bird?
2. What good are birds?

2. What good are birds?
3. What do birds eat?
4. How do birds fly?
5. Why do birds migrate?
6. How do birds breathe?
7. Where do birds live? (woodland, desert)
8. What kind of homes do birds build?
9. How can we help protect and conserve our birds?
10. Do all birds fly forward?

ACTIVITIES

1. Take a field trip using binoculars to observe what birds are seen at KOLab and in this area.
2. Build a feeding station (including drinking fountain).
3. Keep individual bird lists in small notebooks or on bird cards available from the National Audubon Society. (Available from KOLab)
4. Keep a class chart of birds sighted.
5. Listen to record of bird call. (Have children draw impressions).
6. Show films and filmstrip.
7. Have children bring a parakeet, canary, or other pet bird for observation. Observe the toes, beak, eyes, how bird eats, drinks, bathes and dusts or oils itself. Does bird hop or walk?
8. Obtain a feather from a bird's wing or tail. Examine under magnifying glass or microscope.
9. Have children bring in abandoned birds' nests. Observe material used. Consult reference books and try to find out what kind or bird built each nest.
10. Study migration charts and habits.
11. Post pictures or drawings of different kinds of birds' feet, beaks, wings and tails. Include in each picture the names of the birds that have these kinds of body parts.

12. Look for pictures showing birds in their natural setting, which illustrate how the birds' coloring protects them by blending in with their surroundings.

13. Color pictures of birds.

14. Ask someone from Wyoming Game and Fish Department or any qualified person to visit classroom and discuss birds with children.

15. Take a trip to a mating ground (near Opal) to watch sage grouse strutting.

16. Teacher may wish to study birds in groups, such as birds of town and field, birds of woodland and forest, birds of the desert, birds of the sky.

17. Make a collection of types of feathers, such as down, contour, flight, powder down, plume, etc. Label each, tell purpose and use of each.

18. Make a quill pen from a bird feather. (Directions on P. 47 Nature Craft, Golden Press.)

MATERIALS

1. Binoculars

2. Bird Feeders

3. Bird Seed

4. Reference Books - Golden Nature Guide - Birds and Birds of North America are paperbacks that should be available in classroom for children to use as reference.

REFERENCES

Children's Books

598 G	Garelick: What Makes a Bird a Bird?
R500 B	The How and Why Wonder Book of Birds
R500	Peterson: The Birds (Life Nature Library)
598.2	Wasson: Birds
	Robbins, Bruun, Zim: Birds of North America
	Zim, Gabrielson: Birds
598.2	Mason: Robins

590 G Goldin: Ducks Don't Get Wet
598 F Fiore: The Wonder Wheel Book of Birds
598 R Roels: The Penguin
598 R Roels: The Stork
598.2P Palmer: Birds

Dempewolff, Richard F.: Nature Craft, Golden Press
590 B Burnett, Fisher and Zim: Zoology

Records

R520 Dawn in a Duck Blind (with booklet)
R522 The Brook (bird sounds)
R523-525 A Field Guide to Western Bird Songs

Slides

SL 1552-1671 Western Birds

References

Pamphlets

Turtox Service Leaflets Pam TA 161
- No. 29 An Outline of Bird Study

Audubon Nature Bulletins Pam TA 162
- No. 2 Bird Nests
- No. 3 Birds (their adaptations to ways of life)
- No. 21 Mysteries of Bird Migration
- No. 23 Our Friends the Hawks
- No. 24 Owls as Predators
- No. 37 Story of Owls

Pam. TA19 Familiar Birds We should Know (booklet of colored birds)

Film Strips

FS1362 Birds Grow K-1
FS 794 Birds Get Ready for Winter K-3
FS 752 Birds Grow (Same as above)
FS1119 Birds of the Zoo K-3
FS1248 Birds and Nests
FS1245 Birds of Orchard and Woodland (black and white pictures only-no printing) K-6
FS1246 How Young Birds Get Food (black and white) K-6

Transparencies

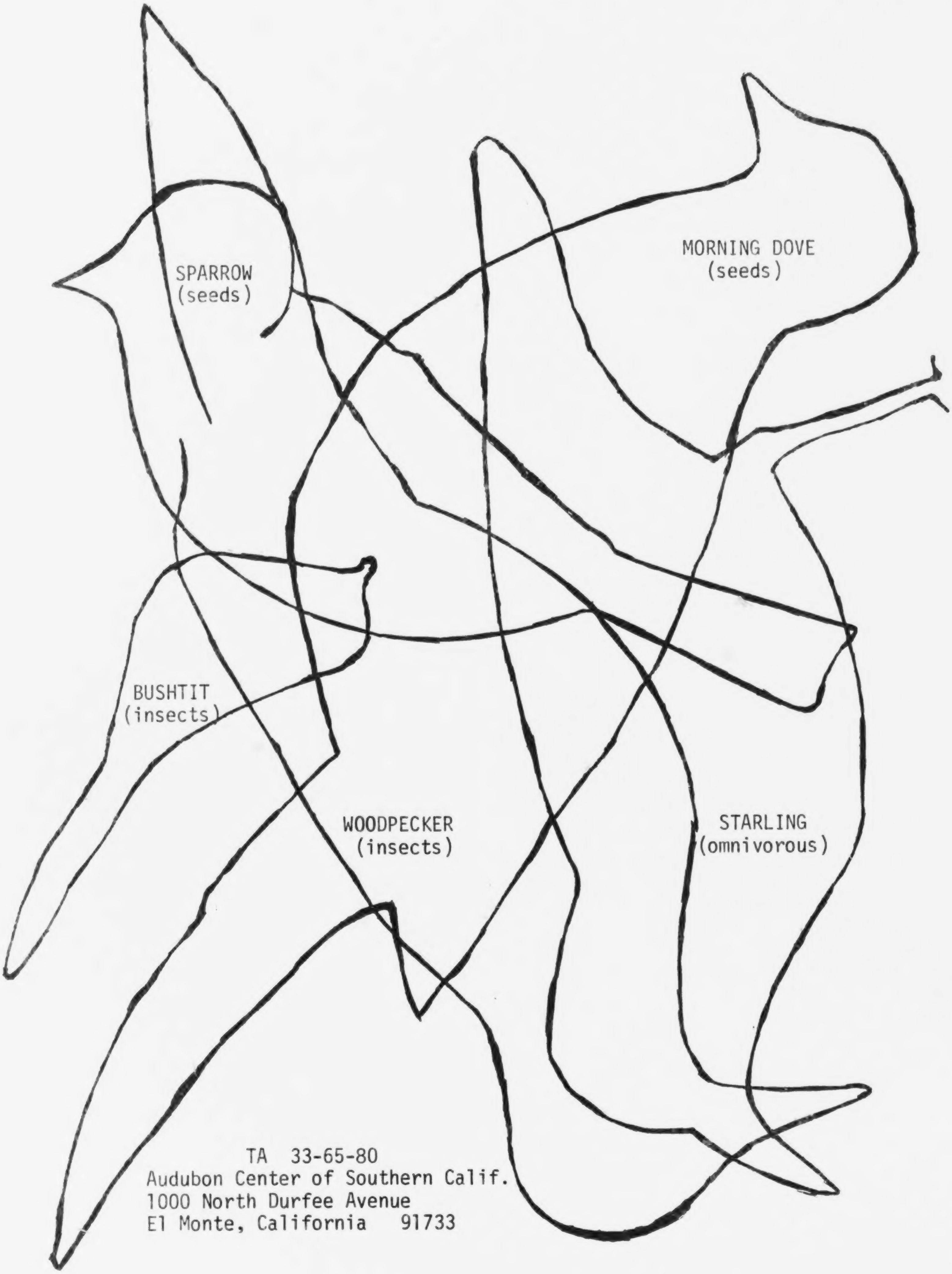
OHT 47 (orig.) Study of Birds

Teacher Reference Books

1. Lewis and Potter: The Teaching of Science in Elementary School
2. Stone and Stephenson: Science You Can Use
3. National Elementary Principal: Science for Today's Children
4. Victor, Edward: Science for Elementary School

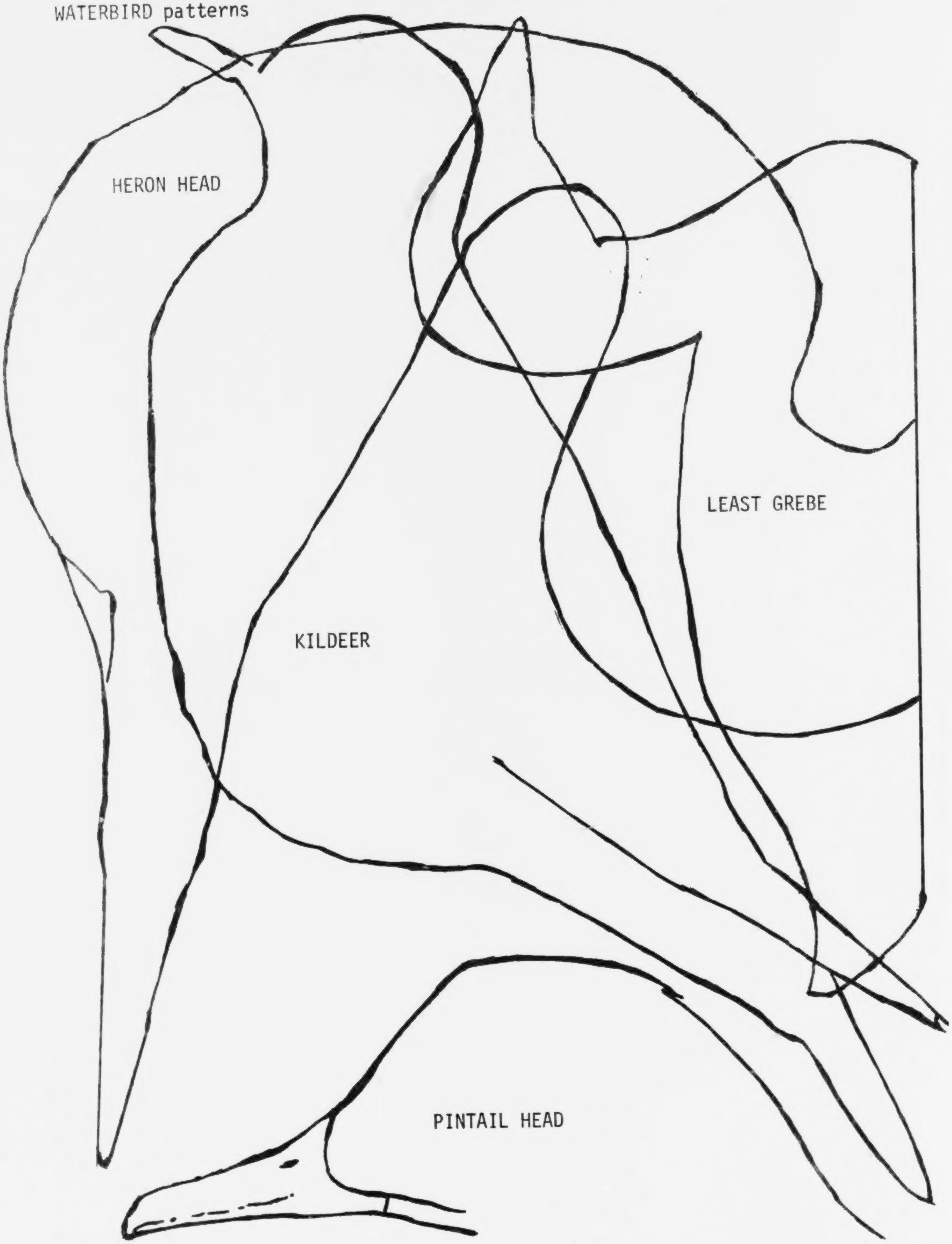
Map C105 Nature Charts
Bird migration
Audubon Bird Calendar

LIFE-SIZE BIRD patterns

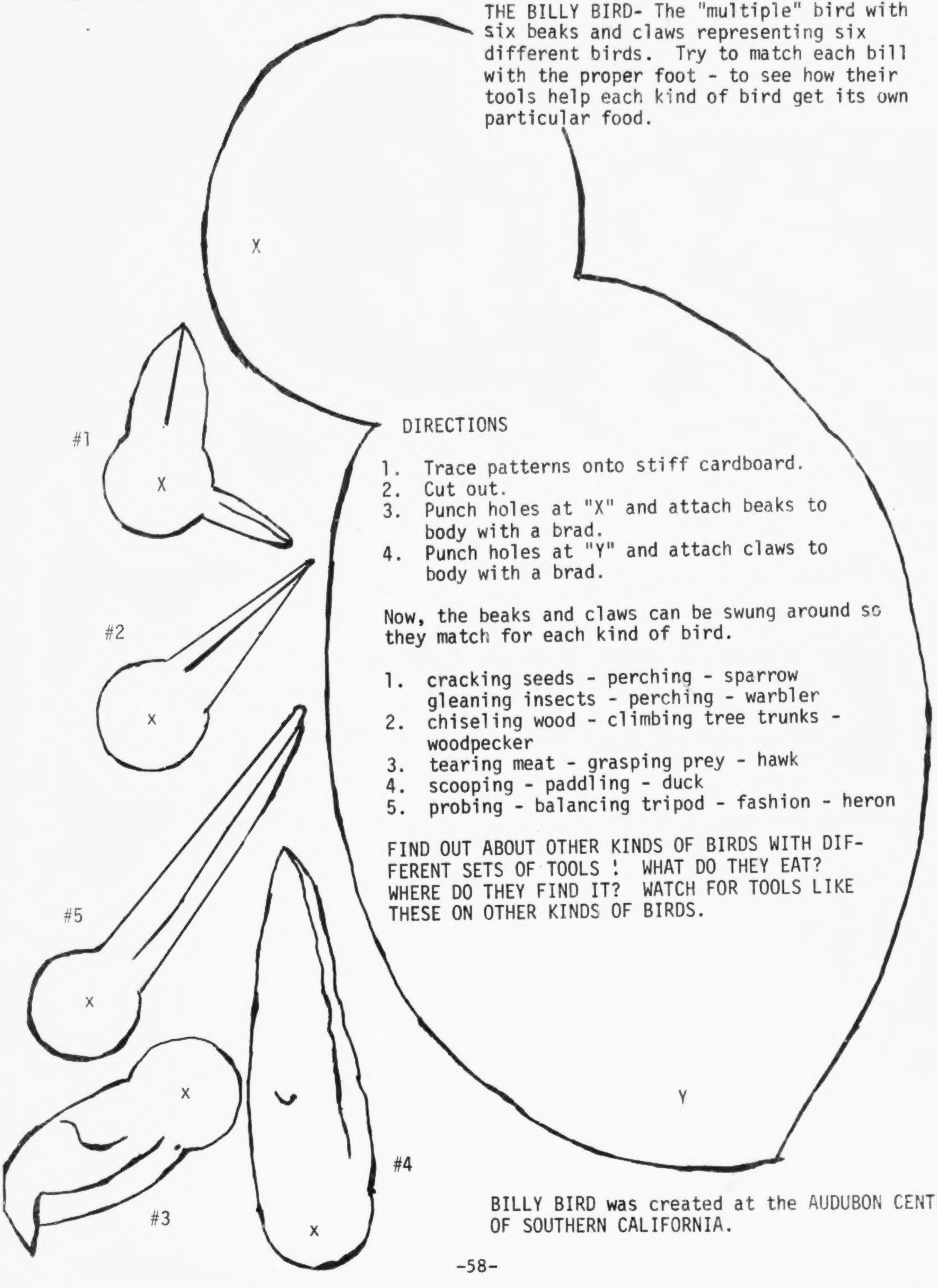

SPARROW
(seeds)
MORNING DOVE
(seeds)
BUSHTIT
(insects)
WOODPECKER
(insects)
STARLING
(omnivorous)

TA 33-65-80
Audubon Center of Southern Calif.
1000 North Durfee Avenue
El Monte, California 91733

WATERBIRD patterns


HERON HEAD
LEAST GREBE
KILDEER
PINTAIL HEAD

BILLY BIRD



THE BILLY BIRD- The "multiple" bird with six beaks and claws representing six different birds. Try to match each bill with the proper foot - to see how their tools help each kind of bird get its own particular food.

DIRECTIONS

1. Trace patterns onto stiff cardboard.
2. Cut out.
3. Punch holes at "X" and attach beaks to body with a brad.
4. Punch holes at "Y" and attach claws to body with a brad.

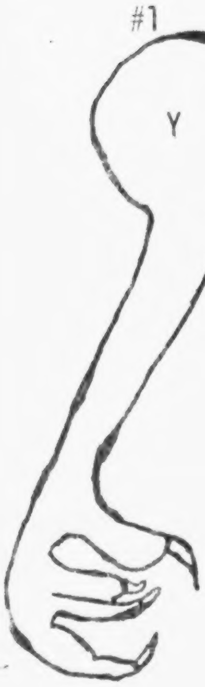
Now, the beaks and claws can be swung around so they match for each kind of bird.

1. cracking seeds - perching - sparrow
   gleaning insects - perching - warbler
2. chiseling wood - climbing tree trunks - woodpecker
3. tearing meat - grasping prey - hawk
4. scooping - paddling - duck
5. probing - balancing tripod - fashion - heron

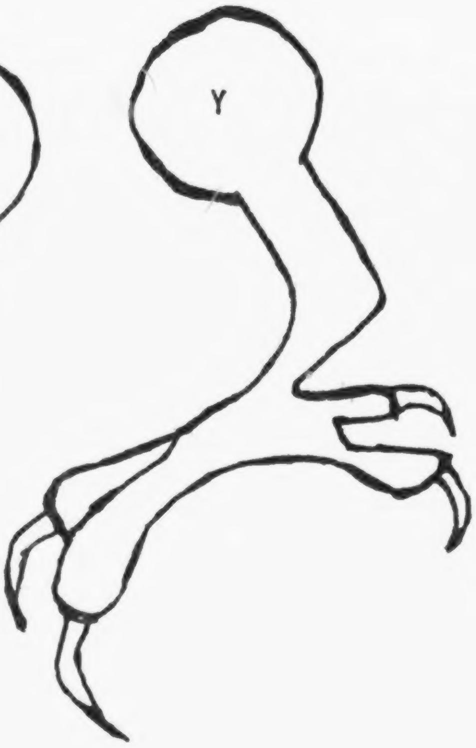
FIND OUT ABOUT OTHER KINDS OF BIRDS WITH DIFFERENT SETS OF TOOLS ! WHAT DO THEY EAT? WHERE DO THEY FIND IT? WATCH FOR TOOLS LIKE THESE ON OTHER KINDS OF BIRDS.

BILLY BIRD was created at the AUDUBON CENTER OF SOUTHERN CALIFORNIA.

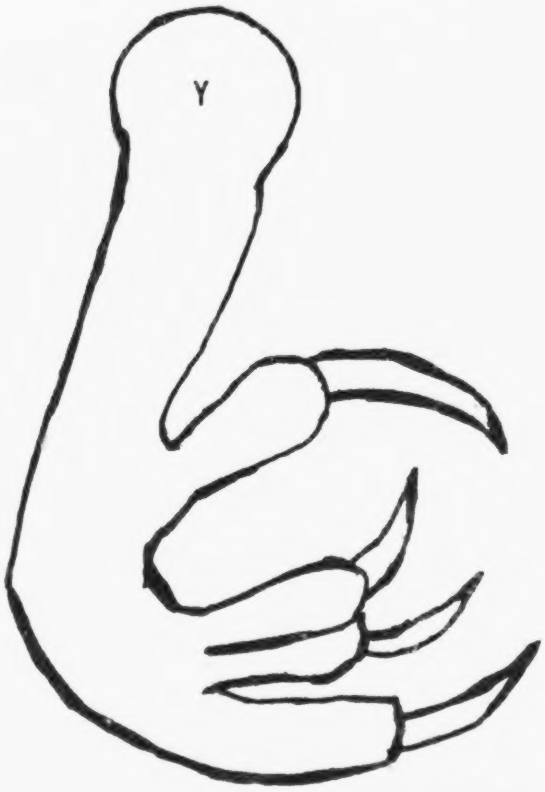
#1



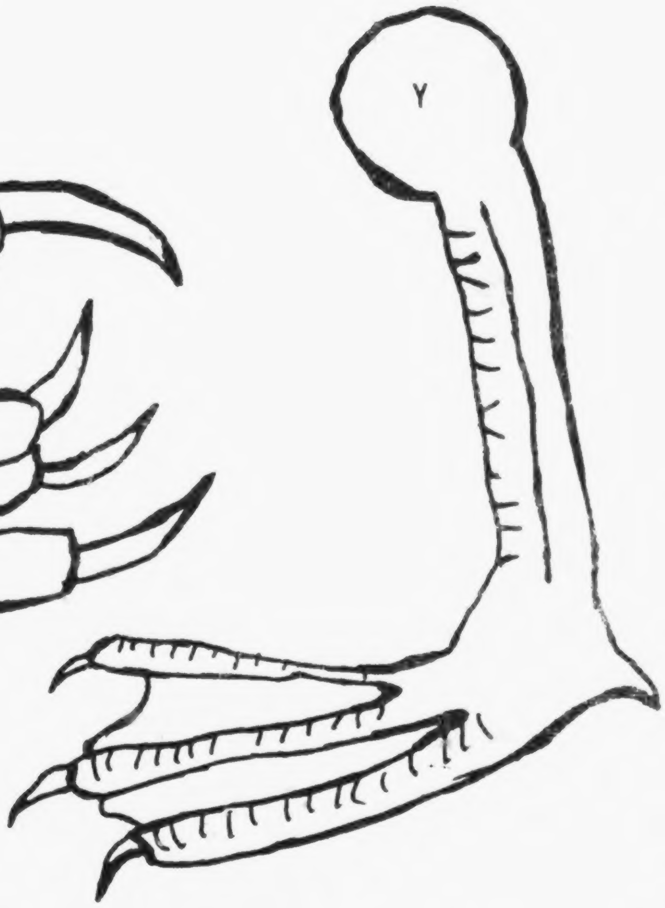
#2



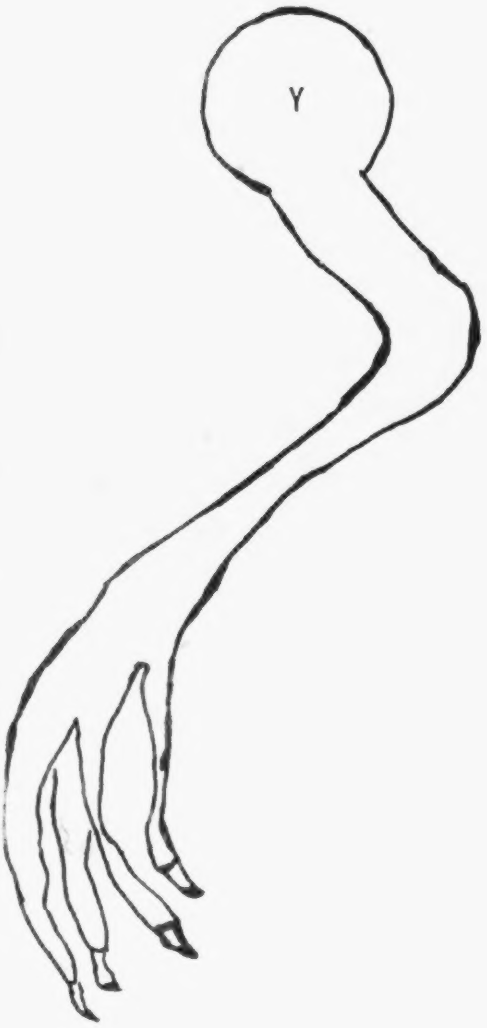
#3



#4



#5



A CHECKLIST OF THE VERTEBRATES
OF THE
BRIDGER NATIONAL FOREST
AND
GREEN RIVER BASIN

By: Charles Sundstrom - Wildlife Biologist U.S.F.S. 1965

There is a growing demand among outdoor enthusiasts for check lists of the fauna and flora of the Bridger National Forest area. This list of vertebrates is presented partly to satisfy this need and partly to solicit information from others who may read this list critically and report to the author additional records heretofore overlooked.

This list is based upon all sight records and collections known to the author. References to support this list are tabulated at the end of this checklist. The author will be glad to supply the reason for including any species that may be questioned by interested persons.

Very rare or accidental species are marked by an asterisk. Underlined names are introduced species.

Birds of Western Wyoming

Common Loon
Horned Grebe *
Eared Grebe
Western Grebe
Pied-billed Grebe
White Pelican
Double-crested Cormorant
Great Blue Heron
Common Egret *
Snowy Egret *
Black-crowned Night Heron *
American Bittern
White-faced Lbis *
Whistling Swan
Trumpeter Swan
(Jackson Hole Area)
Canada Goose
White-fronted Goose *
Snow Goose *
Gadwall
Pintail
Mallard
Green-winged Teal
Blue-winged Teal
Cinnamon Teal
American Widgeon
Shoveler
Wood Duck
Redhead

Cooper's Hawk
Red-tailed Hawk
Swainson's Hawk
Rough-legged Hawk
Ferruginous Hawk

Golden Eagle
Bald Eagle

Marsh Hawk
Osprey

Prairie Falcon
Peregrine Falcon *

Pigeon Hawk *
Sparrow Hawk
Spruce Grouse
White-tailed Ptarmigan
Blue Grouse
Ruffed Grouse
Sage Grouse
Chukar *
Gray Partridge *
Sandhill Crane
Virginia Rail *
Sora
American Coot

Ring-necked Duck
Canvasback
Lesser Scaup
Common Goldeneye
Barrow's Goldeneve
Bufflehead
Harlequin Duck
Ruddy Duck *
Hooded Merganser
Common Merganser
Turkey Vulture (?)
Goshawk
Sharp-skinned Hawk
Rock Dove
Mourning Dove
Black-billed Cuckoo *
Screech Owl
Great Horned Owl
Snowy Owl *
Pygmy Owl
Burrowing Owl
Great Gray Owl
Long-eared Owl
Short-eared Owl
Boreal Owl
Saw-whet Owl
Poor-Will
Common Nighthawk
White-throated Swift

Black-chinned Hummingbird
Broad-tailed Hummingbird
Rufous Hummingbird
Calliope Hummingbird

Belted Kingfisher
Red-shafted Flicker
Lewis' Woodpecker
Yellow-bellied Sapsucker
Williamson's Sapsucker

Hairy Woodpecker
Downy Woodpecker

Northern three-toed Woodpecker
Eastern Kingbird
Western Kingbird
Ash-throated Flycatcher
Say's Phoebe

Traill's Flycatcher
Hammond's Flycatcher
Dusky Flycatcher
Gray Flycatcher
Western Wood Pewee

Kildeer
Common Snipe
Long-billed Curlew
Spotted Sandpiper
Solltary Sandpiper
Willet
Greater Yellowlegs
Lesser Yellowlegs *
Long-billed Dowitcher *
Western Sandpiper
American Avocet
Wilson's Phalarope
California Gull
Ring-billed Gull
Franklin's Gull
Bonaparte's Gull *
Forester's Tern *
Black Tern
Mountain Chickadee
Plain Titmouse
White-breasted Nuthatch
Red-breasted Nuthatch
Pygmy Nuthatch
Brown Creeper
Dipper
House Wren
Bewick's Wren (?)
Long-billed Marsh Wren
Canon Wren
Rock Wren
Mockingbird *
Catbird *
Sage Thrasher
Robin
Hermit Thrush
Swainson's Thrush
Veery
Mountain Bluebird
Townsend's Solitaire
Blue-gray Gnatcatcher
Golden-crowned Kinglet
Ruby-crowned Kinglet
Water Pipit
Bohemian Waxwing
Cedar Waxwing
Northern Shrike
Loggerhead Shrike
Starling
Solitary Vireo
Warbling Vireo

Orange-crowned Warbler
Nashville Warbler *
Yellow Warbler
Audubon's Warbler
Townsend's Warbler

Olive-sided Flycatcher
Horned Lark

Violet-green Swallow
Tree Swallow
Bank Swallow
Rough-winged Swallow
Barn Swallow
Cliff Swallow

Purple Martin *
Gray Jay
Steller's Jay
Black-billed Magpie
Common Raven
Common Crow
Pinon Jay
Clark's Nutcracker
Black-capped Chickadee
Evening Grosbeak
House Finch
Gray-crowned Rosy Finch
Common Redpoll
American Goldfinch
Green-tailed Towhee
Lark Bunting

Vesper Sparrow
Sage Sparrow
Gray-headed Junco
Brewer's Sparrow
White-crowned Sparrow
Lincoln's Sparrow *
Snow Bunting

Northern Waterthrush
MacGillivray's Warbler
Yellowthroat
Yellow-breasted Chat *
Wilson's Warbler
American Redstart
House Sparrow
Bobolink (?)
Western Meadowlark
Yellow-headed Blackbird
Redwinged Blackbird
Bullock's Oriole
Brewer's Blackbird
Brown-headed Cowbird
Western Tanager
Black-headed Grosbeak
Lazuli Bunting
Cassin's Finch
Pine Grosbeak
Black Rosy Finch
Pine Siskin
Red Crossbill
Rufous-sided Towhee *
Savannah Sparrow
Lark Sparrow
Oregon Junco
Chipping Sparrow
Harris' Sparrow *
Fox Sparrow
Song Sparrow

UNIT 10

MAMMALS

CHARACTERISTICS

1. The young of most mammals are born alive.
2. The young of all mammals are fed with their mother's milk.
3. All mammals have some fur or hair on their bodies.
4. All mammals have warm blood.

THINGS TO FIND OUT

1. Are mammals large or small?
2. Where do mammals live?
3. What do mammals eat?
4. How are young of mammals born?
5. Do mammals live in groups?
6. What are prehistoric mammals?
7. How do mammals protect themselves?
8. Are mammals useful to man? How?
9. Do we conserve our mammals?

ACTIVITIES

Class or individual

1. Choose a mammal and discover as much about him as you can.
    - a. his enemies
    - b. food
    - c. home
    - d. others

Do this in a written report or oral report. Drawings or modelings of the students mammal could be included. (Clay)

2. Observe mammals in the city, farm, forest, desert and compare.
3. Keep a mammal in the classroom such as: rabbit, mouse, rat, gerbil, hamster.
4. Listen to records of animal sounds.
5. Collect pictures of mammals (could be used in a college).
6. Draw a mammal in her natural habitat.
7. Draw a mammal with her young.
8. Children make silhouettes of mammals and the class tries to identify them.

REFERENCES

Books

Golden Nature Guide:	Zoology
Golden Nature Guide:	Mammals
Golden Nature Guide:	Zoo Animals
599M Meeks, Ester K.	Mammals
599F Feilen, John	Squirrels
599F Feilen, John	Deer
Leonora and Arthur Hornblow	Animals Do The Strangest Things (Excellent for Primary)
R500 Life Nature Library	The Mammals

500B	Blackwood, Paul E.	The How and Why Wonder Books of Prehistoric Mammals
R500	Life Nature Library	Animal Behavior
R500	Creative Science Series	The Lives of Animals

SEE OTHER 599 BOOKS FOUND IN THE LIBRARY

Filmstrips

FS651-659	Our pet series K-1 (story form)
FS660-668	Animals of the Farm K-2 (story form)
FS1117	A Walk in the Woods K-2 (includes plants and animals)
FS1118	Ann Visits the Zoo K-2 (all zoo animals)
FS1248	Animals to Know K-3 (includes others besides mammals)
FS1363	Rabbits Grow K-3 (good for pet care)
FS 795	Animals Get Ready for Winter K-4 (good)
FS 331	The Desert 1-6 (plant and animal life in the desert)
FS 332	The Arctic Tundra 1-6 (plant and animal life in the Tundra)
FS 333	The Rain Forest 1-6 (plant and animal life in the forest)
FS 328	Age of Mammals 3-6 (first mammals on earth -- good)
FS1365	Interdependence of Plants and Animals 3-6 (good)
FS 152	Animal Life and 4-6 (food chain)
FS 220	Man and Other Primates 5-6 (anatomy)
FS1108	Life at the Timberline K-6 (good)
FS1244	The Life and Work of the Beaver K-6 (drawings and pictures, no captions -- good)

Pamphlets

T.A. 18	Farm Animal Families K-3 (pictures to display -- good)
T.A. 20	Baby Animals at Play K-3 (pictures to display -- good)

Teachers Reference

T.A. 162	Audubon Nature Bulletins
No. 1	Bears of North America
43	Ways of Wildlife in Winter
44	Whales, Porpoises and Sea (ans. P. I)
45	Whales, Porpoises and Sea (ans. P. II)
47	Wildlife Preserves
48	Winter Sleep, Animals that Hibernate

Slides

SL1935-2012	Western Mammals K-6 (good)

Transparencies

OHT52	Animal Life K-6 (good)

Records

R518	Animal Language K-6 (good)
R519	Sounds of Animals at the Zoo Sounds of Animals at the Farm K-6 (good)

Free Bulletins

Wyoming Game and Fish Commission
Our Furry Friends (Excellent 3-6)
Our Big 'N Wild Friends (Excellent 3-6)
You may send for a copy for each child in your class.

MAMMALS OF WESTERN WYOMING

Abundance symbols (abundant, common, uncommon, rare) are shown in the left column.

c	Masked Shrew	Sorex cinereus
c	Vagrant Shrew	Sorex vagrans
r	Dwarf Shrew (Jackson Hole)	Sorex nanus
c	Northern Water Shrew	Sorex palustris
c	Little Brown Myotis	Myotis lucifugus
u	Long-eared Myotis	Myotis evotis
r	Long-legged Myotis	Myotis volans
r	Silver-haired Bat	Lasionycteris noctivagans
r	Hoary Bat	Lasiurus cinerus
r	Big Brown Bat	Eptesicus fuscus
r	Spotted Bat	Euderma maculata
r	Lump-nosed Bat	Plecotus townsendi
c	Pika	Ochotona princeps
c	Snowshoe Hare	Lepus americanus
c	Whitetail Jackrabbit	Lepus townsendii
u	Pigmy Rabbit	Sylvilagus idahoensis

(Note: Sight records but no specimen records for Wyoming as yet)

c	Desert Cottontail	Sylvilagus auduboni
u	Mountain Cottontail	Sylvilagus nuttalli
c	Least Chipmunk	Eutamias minimus
c	Yellow Pine Chipmunk	Eutamias ameonus
c	Uinta Chipmunk	Eutamias umbrinus
	Cliff Chipmunk	Eutamias dorsalis

(Note: 50 miles south of Green River only)

c	Yellowbelly Marmot	Marmota flaviventris
a	Uinta Ground Squirrel	Citellus armatus
c	Golden-mantled Ground Squirrel	Citellus lateralis
r	Richardson's Ground Squirrel	Citellus richardsonii
r	Thirteen-lined Ground Squirrel	Citellus tridecemlineatus
r	Whitetailed Prairie Dog	Cynomys leucurus
c	Red Squirrel	Tamiasciurus hudsonicus
u	Northern Flying Squirrel	Glaucomys sabrins
a	Northern Pocket Gopher	Thomomys talpoides
a	Beaver	Castor canadensis
a	Deer Mouse	Peromyscus maniculatus
	Canyon Mouse	Peromyscus crinitus

(Note: 50 miles south of Green River only)

c	Bushytail Woodrat	Neotoma cinera
c	Grasshopper Mouse	Onychomys leucogaster
c	Harvest Mouse	Reithrodontomys megalotis
c	Boreal Redback Vole	Clethrionomys gapperi
u	Mountain Phenacomys	Phenacomys intermedius
c	Richardson Vole	Microtus richardsoni
a	Meadow Vole	Microtus pennsylvanicus

a	Mountain Vole	Microtus montanus
u	Longtail Vole	Microtus longicaudus
r	Sagebrush Vole	Lagurus curtatus
c	Western Jumping Mouse	Zapus princeps
u	Ord's Kangaroo Rat	Dipadomys ordil
c	House Mouse	Mus musculus
u	Norway Rat	Rattus norvegicus
r	Olive-backed Pocket Mouse	Perognathus fasciatus
c	Muskrat	Ondatra zibethicus
c	Porcupine	Erethizon dorsatum
	Gray Wolf (Extinct)	Canus lupus
c	Coyote	Canis latrans
r	Red Fox	Vulpes vulpes
	Gray Fox*	Urocyon cineroargenteus
r	Kit Fox	Vulpes velox
u	Black Bear	Ursus americanus
r	Grizzly Bear (possibly extinct)	Ursus horribillis
	Fisher*	Martes pennanti
c	Marten	Martes americana
c	Shorttail Weasel	Mustela erminea
c	Longtail Weasel	Mustela frenata
u	Mink	Mustela vison
	Wolverine*	Gulo luscus
	Ringtail Cat*	Bassariscus astutus
c	Badger	Taxidea taxus
u	Spotted Skunk	Spilagle putorius
r	Raccoon	Procyon lotor
u	Striped Skunk	Mephitis mephitis
r	River Otter	Lutra canadensis
r	Mountain Lion	Felis concolor
u	Lynx	Lynx canadensis
u	Bobcat	Lynx rufus
a	Elk	Cervus canadensis
a	Mule Deer	Odocoileus hemionus
c	Moose	Alces alces
c	Pronghorn Antelope	Antilocapra americana
	Bison (captive herd in Star Valley)	Bison bison
u	Bighorn Sheep	Ovis canadensis
	Wild Horse	Equus spp.

(Western edge of Red Desert and possibly Little Colorado Desert).

UNIT 11

REPTILES AND AMPHIBIANS

CHARACTERISTICS

Reptiles

1. Cold blooded
2. Breathe with lungs
3. Dry scaly skin
4. Live on land and in water

Amphibians

1. Cold blooded
2. Breathe with gills and skin
3. Smooth slimy skin
4. Live in water and on land

TEACHERS USE

Reptiles

Snakes, lizards, alligators, turtles, crocodiles, tortise, dinasours, flying dragon, flying snake, chameleons

Amphibians

Salamanders, frogs, toads

THINGS TO FIND OUT

Reptiles

1. Why are some people afraid of reptiles?
2. Do wild animals fear snakes?
3. Are all stores about reptiles true?
4. Are all snakes poisonous? If not, how can you tell?
5. What and how do reptiles eat?
6. How do they move? Do snakes fly?
7. Are reptiles valuable?
8. How did some reptiles get their names?
9. How are reptiles protected?
10. Where do reptiles spend the winter?
11. How do reptiles reproduce?
12. Why the lack of reptiles and amphibians in this area?

Amphibians

1. What are they?
2. How are they born?
3. What do they look like?
4. Can they climb trees?
5. Do toads cause worts?

ACTIVITIES

1. Make a woodland or desert terrarium.
2. Dissection of reptiles or amphibians.
3. Model clay amphibians or reptiles.
4. Field trip to KOLab forest and desert areas.

5. Pick one reptile or amphibian and find out information about it. (Collect pictures, draw, etc.)

6. Make frog and toad comparison

   a. place in separate cartons

   b. watch closely

   c. note differences in movement, skin, color, eye reaction to a finger.

   d. watch reaction to eating flies

   e. frog in cold water reacts as if in hibernation

7. Raise tadpoles

   a. place eggs in aquarium filled with water plants and observe with magnifying glass.

8. Keep and observe salamanders in woodland terrarium

   a. use strong light to see how they react

   b. feel skin

9. Turtles

   a. put in woodland terrarium with water supply (water turtles eat only in H_2O)

   b. poke turtles with sticks and observe behavior

   c. observe blinking

   d. count toes

   e. do they have teeth?

10. Snakes

   a. large aquarium tank covered by zinc mesh

   b. clean cage once a week by flushing with water

   c. do eyes blink?

   d. are there any ears?

   e. what use is fork tongue?

   f. find out what poisonous snakes in area and learn to identify.

g. what is first aid treatment for snake bite?

h. other poisonous snakes and where found?

11. Lizards (Found in area horned toad)

    a. put in woodland or desert terrarium

    b. observe skin

    c. use of tail

    d. movement

    e. number of toes

    f. do they have claws?

    g. how do they get food?

12. Alligators

    a. raise a baby alligator

13. Dinosaurs

    a. make individual dioramas from boxes

    b. model dinosaurs or collect plastic ones

    c. sand etc. in box to simulate habitat

    d. find out what plants looked like at this time

    e. compare size of dinosaurs to tree or house
    making model of one if possible

REFERENCES

Science for the Elementary School - Victor
(what to feed classroom reptiles and amphibians)

Bibliography

Books and Resource Units LMC

Victor, Edward Science for the Elementary School

Carr, Archie The Reptiles

Reptiles and Amphibians, a guide to familiar American species, KOLab Resource Center (4 individual copies)

Reptiles and Amphibians, How and Why Wonder Book

Dinosaurs, The How and Why Wonder Book

Inger, Robert F. The Reptiles

KOLab Resource Unit 380

Animal Development 3ADIC - 3ADID - 3AD4A See -L.M.C.

Aliki, My Visit to the Dinosaurs

Tondow and Lundi, Discovering Dinosaurs

Slides

1934 Western Reptiles LMC

Filmstrips LMC

FS327	1-6	Reptiles Inherit the Earth Part V
FS725	1-6	Amphibians
FS726	1-6	Turtles
FS727	1-6	Crocodiles and Lizards
FS728	1-6	Snakes
FS729	1-6	Life in Ponds, Lakes and Streams
FS731	1-6	Fresh Water Shell Fish
FS732	1-6	Fresh Water Turtles and Fish
FS751	1-3	Toads Grow
FS1366	1-6	How Dinosaurs Live
FS1115	K-3	Animals of the Pond
FS1116	K-3	The Turtles
FS1112	K-3	Plants and Animals of Desert
FS652	K-1	My Turtle

Microslides

REA 52 #16 From Tadpole to Frog 2-6

Transparencies

Life Cycle of a Frog OHT272 1-6

Pamphlets

TA162

Audubon Nature Bulletins

No. 10	Frogs and Toads
17	Life in a Pond
31	Salamanders
33	Snakes
42	Turtles

UNIT 12

ARTHROPODS

OBJECTIVES

1. To extend the children's present interests in the world of insects, and to help them gain an appreciation of nature.

2. Observations, experimentation, the checking of ideas the recording of data, the use of measurements, and thinking.

3. Conservation of Natural Resources

TERMS

Insecticide - chemical compound used to control insects which are pests.

Exoskeleton - skeleton on the outside - humans have skeletons inside their bodies; the exoskeleton is composed of a hard horny material called "Chitin" (ky-tin).

Arthropod - "jointed foot"

Metamorphis - "change" cocoon, pupa, larva, etc.

Entomology - study of insects

"Royal Jelly" - a paste fed the Queen only, made from special glands in the workers' mouths.

Social Castes - consist of the Queen, workers, drones, etc.

Compound Eye - composed of many facets (parts); for example: bee.

Antenna - hair-like appendage which serves as the "ear", "nose", "tongue", and "fingertips" of butterflies and moths, and other insects.

Pollination - Process in which pollen is spread by bees and other insects from flower to flower.

THINGS TO FIND OUT

1. Using insect specimen, explain the term "Arthropod."
2. How do the insects range in size?
3. Name ways and examples of how insects protect themselves.
4. Are there any poisonous arthropods? Name them.
5. The bee is a beneficial (helpful) insect. Explain.
6. What are some useful products of insects which we use in our everyday living?
7. Some insects destroy plants. Which insects do this?
8. What is the difference between an insect and a spider?
9. What are some diseases caused by arthropods?

ACTIVITIES

1. Make a diagram, labeling the parts of an insect.
2. Observe an insect under a microscope, or using a magnifying glass.
3. Observe an ant hill, making a "scent trail" with food; erase the scent by drawing a thumbmark across the trail - watch the reactions of the ants as they come to a break in the trail.
4. Next to a picture of an arthropod, mount a useful product obtained from it.
5. Field trips to a pond, observing and drawing water arthropods.
6. Collection of drawing of moths and butterflies, or spiders; underneath the drawing a short summary of the particular arthropod.

7. Make an "Insectarioum" using a white sheet to collect the insects. Spread an old white sheet under a bush, shake the bush, and the insects should fall on to the sheet. Before going on this field trip, view the film loop "Microscopic Insect Collecting" with the class.

8. Keep ants in a bell jar which is filled with soil and has the sides covered with dark paper, so as to encourage the ants to make tunnels.

9. Using a "killer jar" (chloroform works well) mount arthropods on cardboard or pegboard, label and cover with glass. Resin is also a good material to use for mounting insects.

10. Ant - Hunt - Look under flat rocks and rooting logs, for black ants preferably, as the red ones bite! When you find a nest, dig into it, spread out the dirt and start getting the ants to run up a stick, then brush them off onto the white sheet and into a jar (lid punctured with holes). When you have collected about 50, pick up 20 or 30 of the small white eggs and grubs. To find the Queen, dig deeply into the center of the nest and spread each load onto the sheet - the Queen will be the largest ant.

11. Observe and record the relationship between ants and aphids; this can be done by visiting the KOLab.

12. Use the Insect Rack Track (KOLab)

13. Listen to the record "The Swamps in Spring", then organize a field trip to a swamp and try to recognize the sounds heard on the record.

14. Insect - Collecting - Hunt -- Use insect collecting jars. (KOLab)

15. Make a study concerning the effects of certain insecticides, such as DDT, on insects and other animals and on plants.

TEACHER INFORMATION

1. Class of Arthropods

    a. Crustacea - lobster, crab, shrimp

    b. Arachnids - spiders, ticks, mites, scorpoins

    c. Insects - grasshoppers, bees, ants, butterflies

2. Harmful Arthropods
    - a. Black Widow Spider
    - b. Cotton Boll-Weevil
    - c. Grasshopper
    - d. Termite
3. Helpful Arthropods
    - a. Honey Bee
    - b. Butterfly

MATERIALS

Bell Jar
Insect Collection Kit (KOLab)
Microscope
Magnifying Glass
Nets
Small Collecting Boxes
Screening
Insect Collecting Jars (KOLab)
Resource Units Concerning Insects (KOLab)
White Sheet

REFERENCES

Transparencies

Ant Colony OHT260
Life Cycle of the Butterfly OHT261

Film Loops (with accompanying booklets)

FL20 Harmful Insects (ele.)
FL21 Helpful Insects (ele.)
FL29 Caterpillar to Moth (ele.)
FL30 Microscopic Insect Collecting (3-6)

Filmstrips

FS757	How Do Insects Protect Themselves (K-3)
FS756	Insect Homes (K-3)
FS755	Finding Out About Insects (K-3)
FS1247	What Is An Insect (3-6)
FS1113	The Growing Up of the Monarch Butterfly (4-6)
FS759	Collecting Insects (K-3)
FS758	Our Insect Enemies and Insect Friends (K-3)
FS218	Arthropods (5-6)
FS796	Insects Get Ready For Winter (K-3)

Books

Ants - Charles A. Schoenkneckt
How Insects Grow - Gladys Conklin
Ants and Bees - Ronald N. Rood

Golden Nature Series

- Butterflies and Moths
- Insect Pests
- Spiders
- Walt Disneys Secrets of Life
- Caterpillars
- The How and Why Wonder Book of Insects
- Insects and Their Ways
- The Wonder World of Ants
- Science on the Shores and Banks

Audubon Nature Bulletins

No. 11 How Insects Benefit Man
16 The Insect Orchestra
18 Life of the Honey Bee
20 Live Insects in the Classroom
36 Spiders and Silk
46 What Good Are Insects?

KOLab Resource Development Units

- Butterfly Life Cycle
- Housefly Life Cycle
- Housefly - Characteristics
- Mosquito Life Cycle
- Mosquito - Characteristics
- Ant Colony
- Beehive
- Animal Comparison
- Insect Collection

Records

"The Swamps in Spring" (in Animal Behavior Unit)

Teachers Editions

Science Curriculum Guide for Elementary Grades (KOLab)
Activities and Experiments

TO WRITE FOR ANT SUPPLY:

Cossman & Levine, Inc.
1238 N. Highland Avenue
Department A.H.
Hollywood, California 90038

Audubon Camp of the West

HOW TO KNOW THE ORDERS OF ADULT INSECTS

Key to the Order of Insects

1. Winged Insects 2
   Wingless Insects 24

2. Forewings horny, leathery or parchmentlike, at least at the base; hindwings membranous or absent 3
   Wing membranous 8

3. Forewings veined or hindwings not folded crossways when under forewings 4
   forewings uniformly horny and veinless; hindwings, if present, folded crossways and lengthwise when under forewings 7

4. Mouthparts a jointed beak for piercing and sucking 5
   Mandibles move laterally; mouthparts chewing 6

5. Mouthparts (beak) arising from front part of head; forewings usually leathery at the base and membranous at the tip, the tips generally overlapping when at rest (Bugs) HEMIPTERA
   Beak arising from back part of head, often appearing to arise from base of front legs; forewings of uniform texture throughout, the tips not or only slightly overlapping when at rest (Hoppers) HOMOPTERA

6. Wings similar in size, shape and venation, not folded; social forms living in colonies (Termites) ISOPTERA
   Hindwings folded and broader than forewings ORTHOPTERA

7. Abdomen terminated by pincers (Earwigs) DERMAPTERA
   Abdomen not terminated by pincers (Beetles) COLEOPTERA

8. With two wings 9
   With four wings 12

9. Body grasshopperlike ORTHOPTERA
   Body not grasshopperlike 10

10. Abdomen without threadlike or stylelike tails — (Flies) DIPTERA
Abdomen with threadlike or stylelike tails — 11

11. Hindwings represented by minute hooklike structures; antennae long and conspicuous; minute, usually under 5 mm long — (Scale Insects) HOMOPTERA
No hindwing representation; antennae short; usually over 5 mm long — (Mayflies) EPHEMEROPTERA

12. Wings mostly or entirely covered with scales; mouth parts for sucking, usually in the form of a coiled projection — LEPIDOPTERA
Wings transparent or thinly clothed with hair — 13

13. Wings long and narrow, the margins fringed with long hairs — (Thrips) THYSANOPTERA
Wings not as above; if wings are somewhat linear, then the tarsi have more than two segments — 14

14. Hindwings smaller and with fewer veins than forewings — 15
Hindwings as large or larger and with as many or more veins than forewings — 19

15. Forewings with many cross veins and cells; antennae short and bristlelike; abdomen with two or three long threadlike tails — (Mayflies) EPHEMEROPTERA
Forewings with few cross veins and cells; no threadlike tails if antennae are short — 16

16. Tarsi of two or three segments — 17
Tarsi of four or five segments, usually five — 18

17. Mouthparts arising from back of head, often appearing to arise from base of front legs; sucking — HOMOPTERA
Mouthparts normally situated at the front of the head; chewing — CORRODENTIA

18. Wings noticeably hairy; wing venation similar — TRICHOPTERA
Wings not visibly hairy; fewer veins and cells in hindwings — HYMENOPTERA

19. Tarsi of three or four segments 20
Tarsi of five segments 23

20. Antennae inconspicuous, small, short, bristlelike
ODONATA
Antennae long and conspicuous 21

21. Tarsi of front legs enlarged, males
EMBIOPTERA
Tarsi of front legs normal 22

22. Wings of similar size, shape and venation
ISOPTERA
Hindwings larger than forewings
PLECOPTERA

23. Front margin of forewings with numerous cross veins
NEUROPTERA
Front margin of forewings with one or two cross veins
MECOPTERA

24. Free-living; body usually neither flattened nor leathery 25
Usually external parasites of birds or mammals; body essentially leathery and flattened 39

25. Abdomen provided with a spring; not more than six abdominal segments visible
COLLEMBOLA
Abdomen not provided with a spring; abdomen with more than six visible segments 26

26. Abdomen with three terminal, bristlelike appendages
Abdomen without three terminal, bristlelike appendages
THYSANURA 27

27. Mouthparts drawn into head and not apparent; abdomen with at least nine segments, some containing stylelike appendages
THYSANURA
Mouthparts distinctly chewing or sucking; no stylelike appendages 28

28. Abdomen constricted at the base (ants, wasps)
HYMENOPTERA
Abdomen not constricted at the base, nearly as broad as thorax. 29

29. Tarsi three-segmented, basal segment of front tarsus swollen
EMBIOPTERA
Tarsi if three segments does not have basal segment swollen 30

30. Body covered with scales (Wingless Moths)
LEPIDOPTERA
Body not covered with scales 31

31. Mouthparts sucking with elongate beak extending backwards from head or cone-shaped and directed downward 32
Mouthparts chewing; when present beak is fairly long and directed down 34

32. Minute insects with long and narrow bodies; beak cone-shaped
THYSANOPTERA
Body usually more or less oval; size variable 33

33. Beak arising from front part of head
HEMIPTERA
Beak arising from back part of head
HOMOPTERA

34. Abdomen terminated by pincers
DERMAPTERA
Abdomen without pincerlike cerci 35

35. Mouthparts a downward directed beak
MECOPTERA
Mouthparts not in the form of a beak 36

36. Small crawling and running louse-like insects; external skeleton soft or tough; prothorax small and inconspicous
CORRODENTIA
Not louse-like; external skeleton generally hard prothorax large 37

37. Hindlegs enlarged for jumping
ORTHOPTERA
Hindlegs not enlarged for jumping 38

38. Tarsi of four segments; whitish, soft-bodied
ISOPTERA
Tarsi of five segments
ORTHOPTERA

39. Mouthparts chewing 40
Mouthparts sucking, sometimes the piercing parts are withdrawn 41

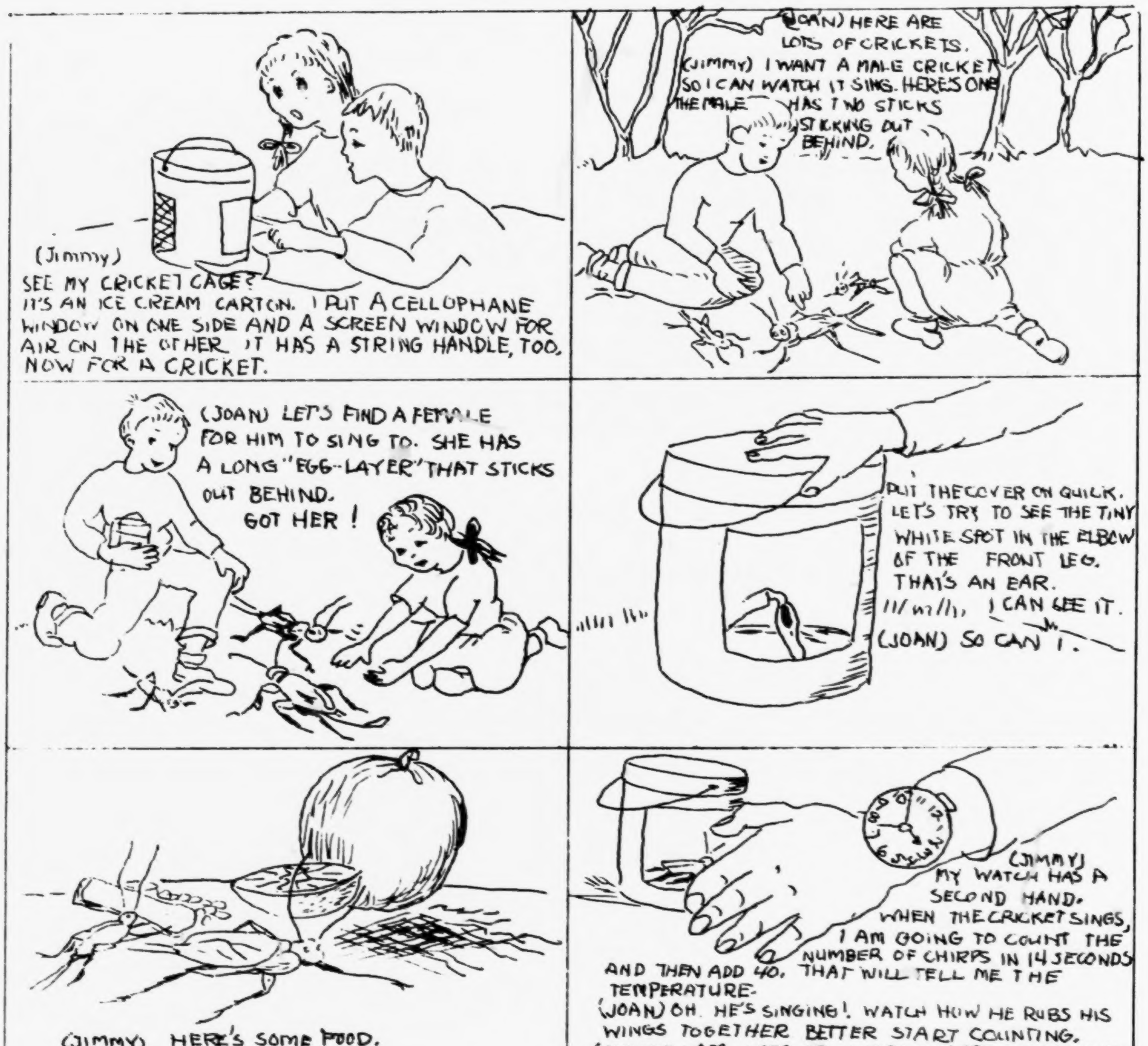
40. Antennae of five or less segments; tarsi with one (mammal parasites) or two (bird parasites) claws (chewing lice)
MALLOPHAGA
Antennae more than five segments; not parasites
CORRODENTIA

41. Body compressed from side to side; jumping insects
SIPHONAPTERA
Body compressed from top to bottom do not jump 42

42. Antennae hidden from above in grove beneath the head
(Louse-Flies) DIPTERA
Antennae not hidden from above, usually conspicuous 43

43. Beak elongate, extending back below body
HEMIPTERA
No beak, short anterior projecting snout
ANOPLEORA

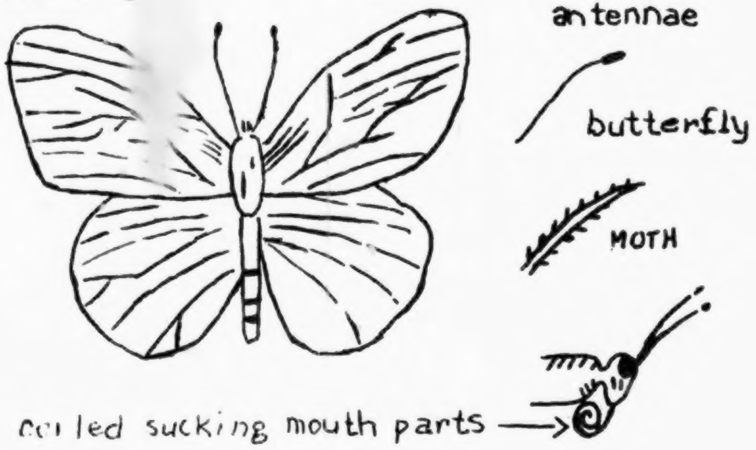
The Temperature by Crickets


(Jimmy) SEE MY CRICKET CAGE? IT'S AN ICE CREAM CARTON. I PUT A CELLOPHANE WINDOW ON ONE SIDE AND A SCREEN WINDOW FOR AIR ON THE OTHER. IT HAS A STRING HANDLE, TOO. NOW FOR A CRICKET.
(JOAN) HERE ARE LOTS OF CRICKETS.
(JIMMY) I WANT A MALE CRICKET SO I CAN WATCH IT SING. HERE'S ONE. THE MALE HAS TWO STICKS STICKING OUT BEHIND.
(JOAN) LET'S FIND A FEMALE FOR HIM TO SING TO. SHE HAS A LONG "EGG-LAYER" THAT STICKS OUT BEHIND.
GOT HER!
PUT THE COVER ON QUICK. LET'S TRY TO SEE THE TINY WHITE SPOT IN THE ELBOW OF THE FRONT LEG. THAT'S AN EAR. I CAN SEE IT.
(JOAN) SO CAN I.
(JIMMY) HERE'S SOME FOOD. CRICKETS LIKE APPLE, WOOL AND DOG BISCUIT.
(JIMMY) MY WATCH HAS A SECOND HAND. WHEN THE CRICKET SINGS, I AM GOING TO COUNT THE NUMBER OF CHIRPS IN 14 SECONDS AND THEN ADD 40. THAT WILL TELL ME THE TEMPERATURE.
(JOAN) OH. HE'S SINGING!. WATCH HOW HE RUBS HIS WINGS TOGETHER. BETTER START COUNTING.
(JIMMY) I AM. I GET 28 CHIRPS IN 14 SECONDS. PLUS 40 THAT MAKES 68.
(JOAN) THAT'S GOOD!. THE THERMOMETER SAYS 67. BUT MAY BE IT IS WARMER IN THE CAGE,

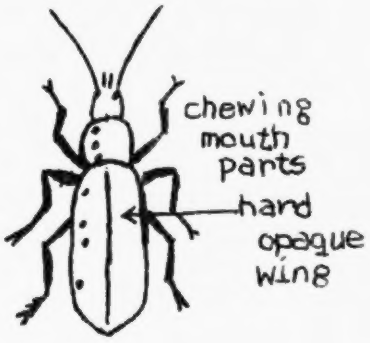
EIGHT COMMON INSECT ORDERS

Phylum: Arthopoda Class: Insecta

LEPIDOPTERA - Butterflies & Moths
(scale wing)

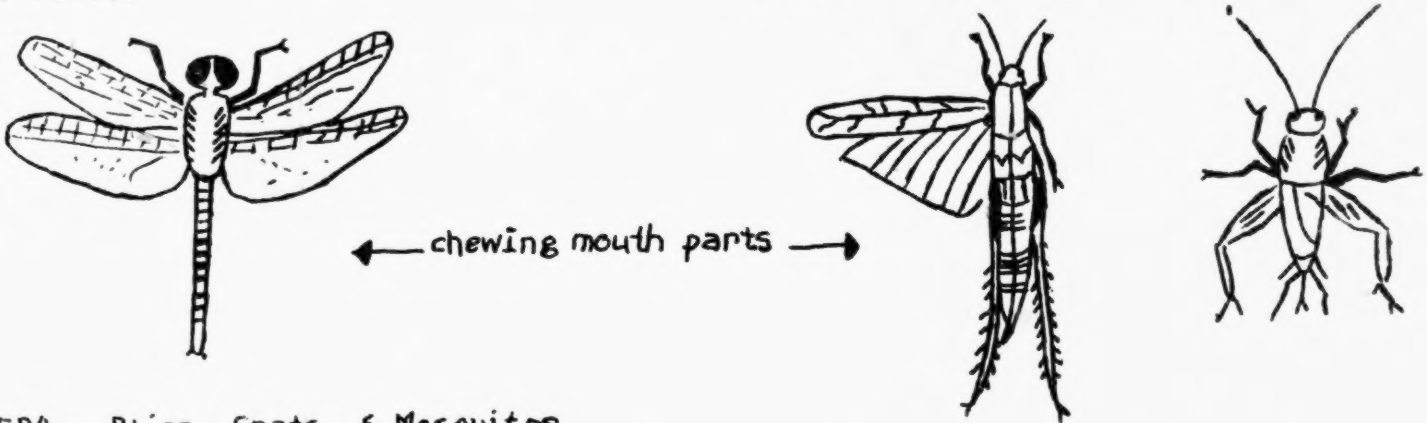

antennae
butterfly
MOTH
coiled sucking mouth parts

COLEOPTERA - Beatles & Weavils
(sheath wing)

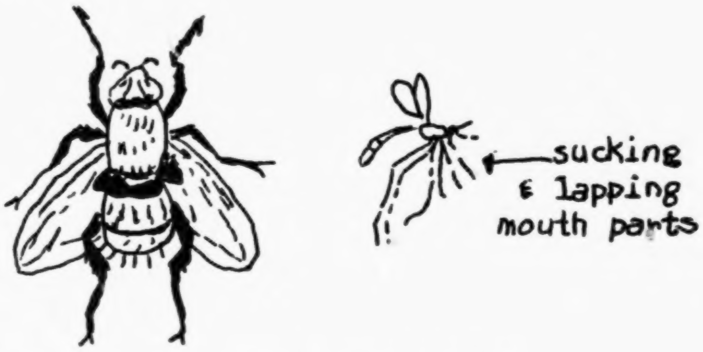

chewing mouth parts
hard opaque wing

ODONATA - Dragonflies & Damselflies
(with tooth)

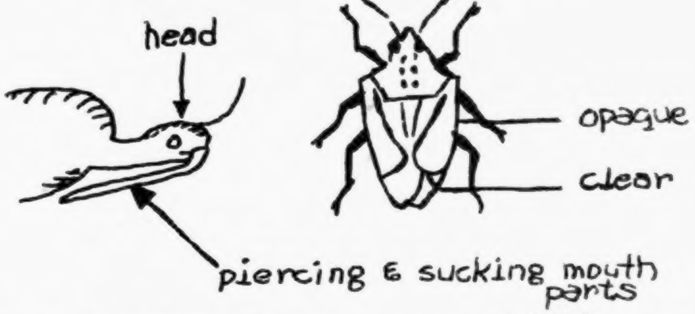
ORTHOPTERA - Grasshoppers, Crickets, Katydids & Cockroaches
(straight wing)


chewing mouth parts

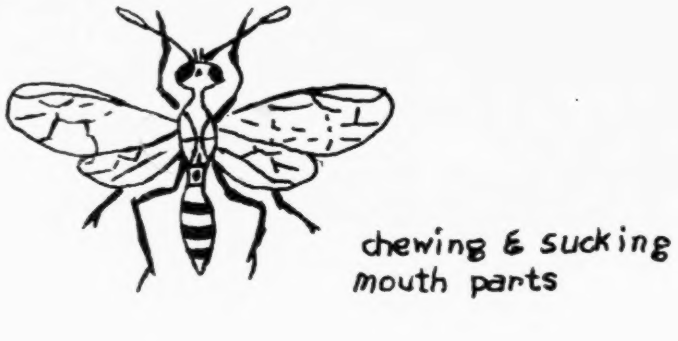
DIPTERA - Flies, Gnats, & Mosquitos
(two wing)


sucking & lapping mouth parts

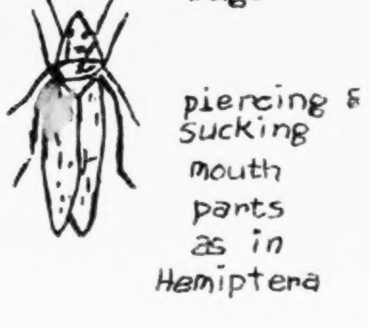
HEMIPTERA - True Bugs
(half wing)


head
opaque
clear
piercing & sucking mouth parts

HYMENOPTERA - Bees, Wasps & Ants
(membrane wing)


chewing & sucking mouth parts

HOMOPTERA - Leafhoppers, Aphids, Cicadas & Spittle-bugs
(same wing)

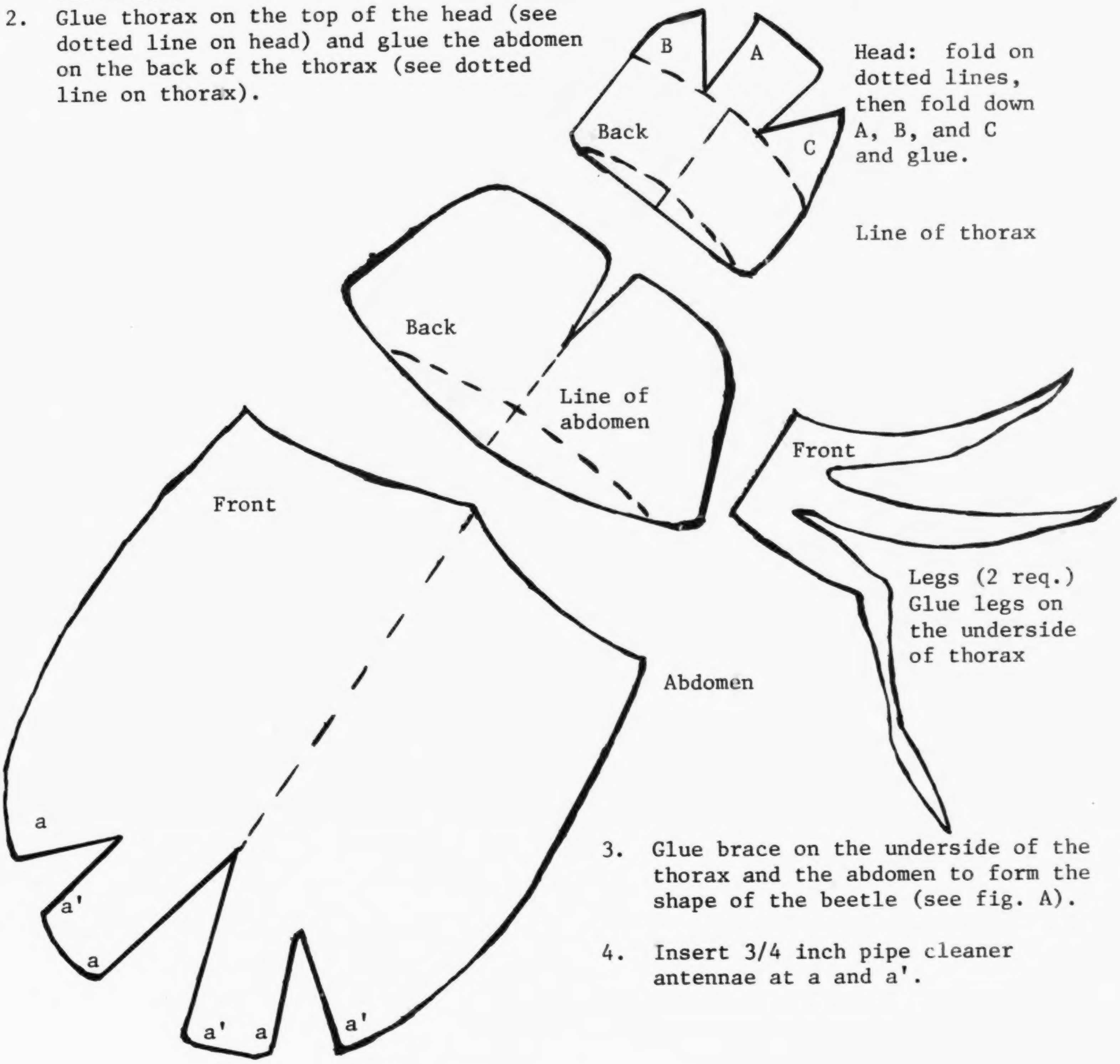

piercing & sucking mouth parts as in Hemiptera

Audubon Camp of the West
Insect Cut-Outs by Carl Miescke

BEETLE

Body assembly instructions:

1. Assemble each body parts. Glue cuts a - a' together with a strip of paper on the underside.
2. Glue thorax on the top of the head (see dotted line on head) and glue the abdomen on the back of the thorax (see dotted line on thorax).


B
A
Back
C
Back
Line of abdomen
Front
Front
Abdomen
a
a'
a
a'
a
a'

Head: fold on dotted lines, then fold down A, B, and C and glue.

Line of thorax

Legs (2 req.) Glue legs on the underside of thorax

3. Glue brace on the underside of the thorax and the abdomen to form the shape of the beetle (see fig. A).

4. Insert 3/4 inch pipe cleaner antennae at a and a'.

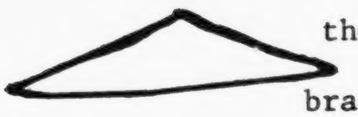
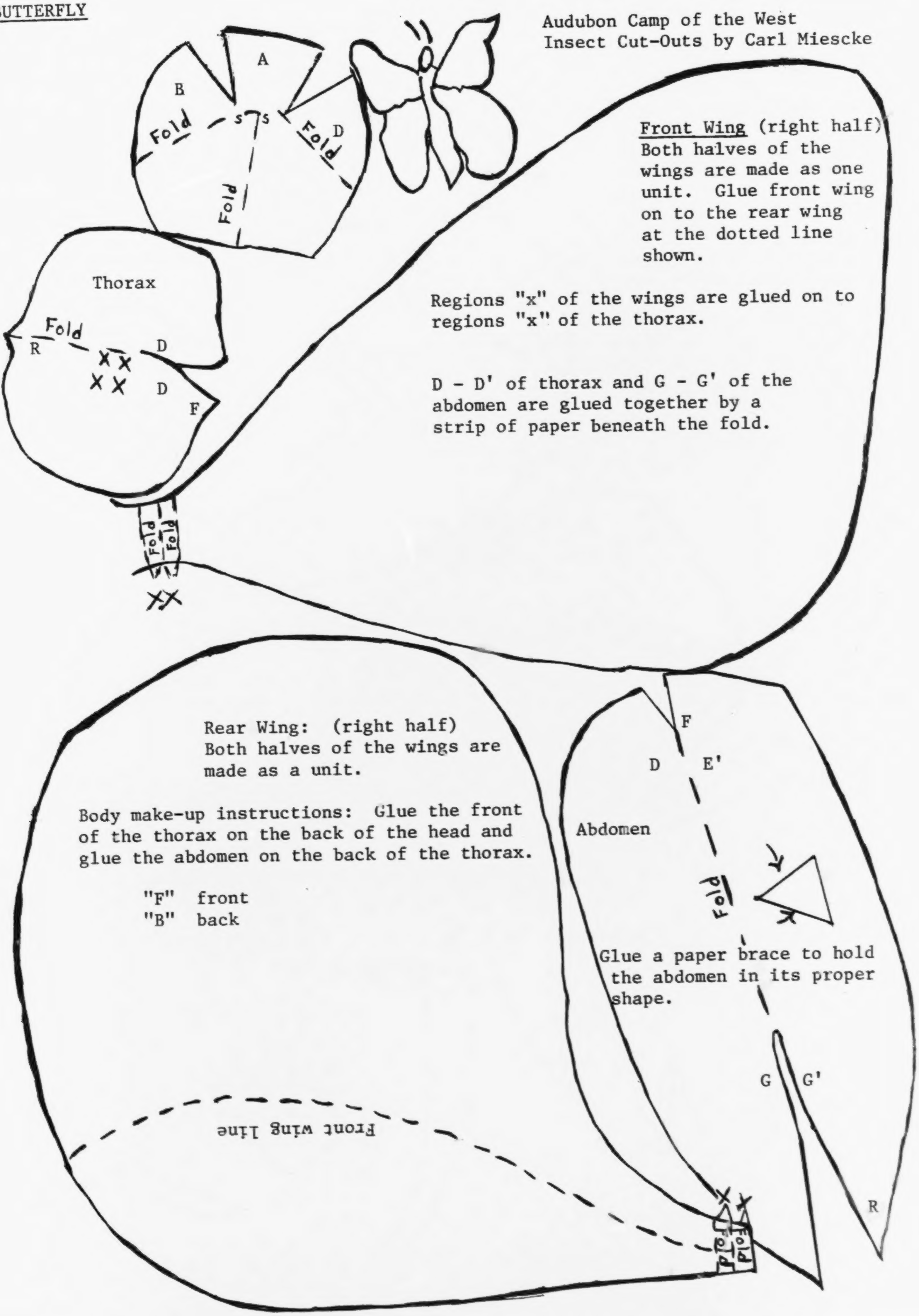

thorax
brace

Fig. A

BUTTERFLY

Audubon Camp of the West
Insect Cut-Outs by Carl Miescke


A
B
Fold
S
S
Fold
D
Fold
Thorax
Fold
R
D
X X
X X
D
F
Fold
Fold
X X
F
D
E'
Abdomen
Fold
G
G'
R
Front wing line
X
X
Fold
Fold

Front Wing (right half)
Both halves of the wings are made as one unit. Glue front wing on to the rear wing at the dotted line shown.

Regions "x" of the wings are glued on to regions "x" of the thorax.

D - D' of thorax and G - G' of the abdomen are glued together by a strip of paper beneath the fold.

Rear Wing: (right half)
Both halves of the wings are made as a unit.

Body make-up instructions: Glue the front of the thorax on the back of the head and glue the abdomen on the back of the thorax.

"F" front
"B" back

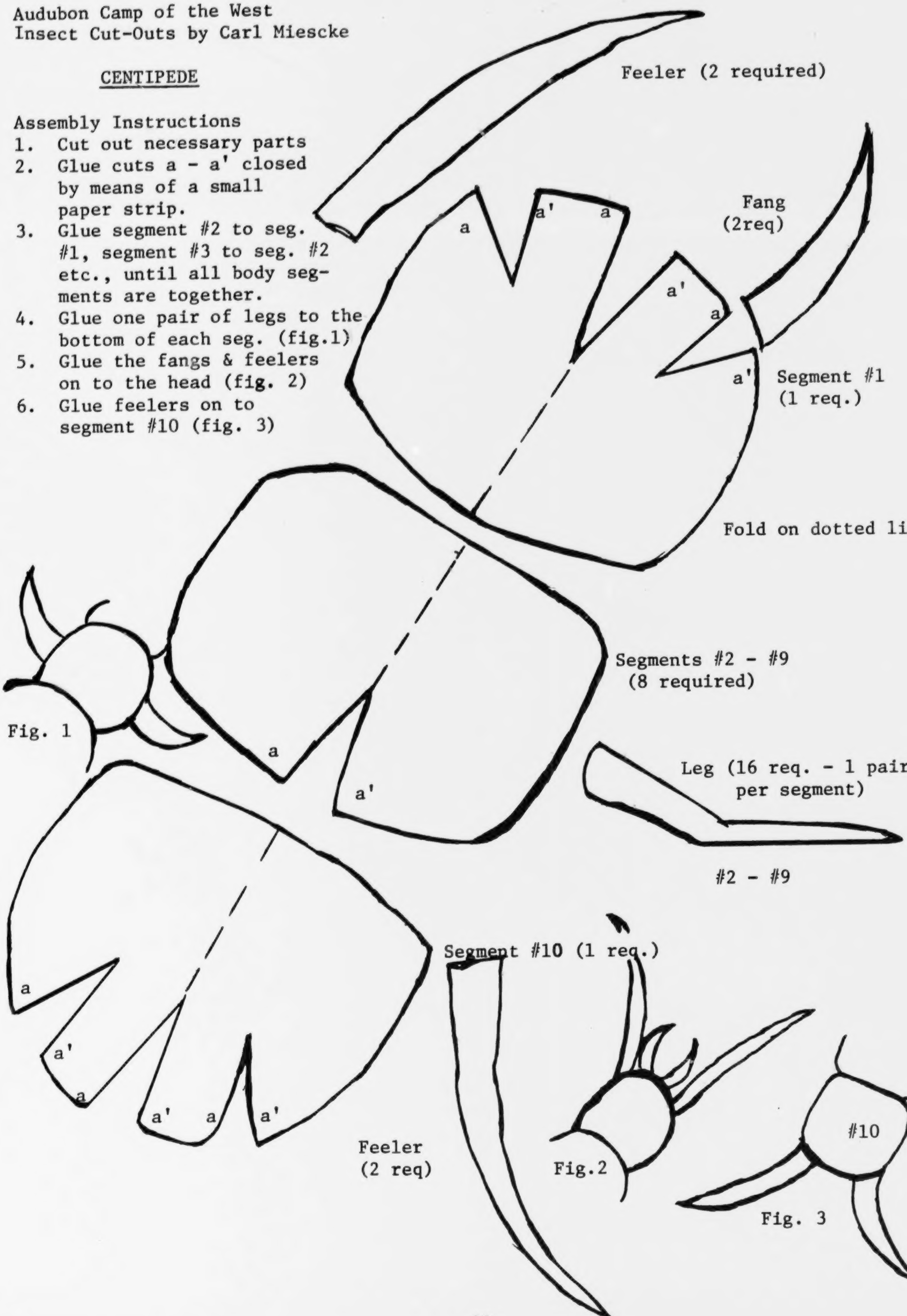
Glue a paper brace to hold the abdomen in its proper shape.

Audubon Camp of the West
Insect Cut-Outs by Carl Miescke

CENTIPEDE

Assembly Instructions

1. Cut out necessary parts
2. Glue cuts a - a' closed by means of a small paper strip.
3. Glue segment #2 to seg. #1, segment #3 to seg. #2 etc., until all body segments are together.
4. Glue one pair of legs to the bottom of each seg. (fig.1)
5. Glue the fangs & feelers on to the head (fig. 2)
6. Glue feelers on to segment #10 (fig. 3)


Feeler (2 required)
Fang
(2req)
a
a'
a
a'
a
a'
Segment #1
(1 req.)
Fold on dotted lines.
Segments #2 - #9
(8 required)
Fig. 1
a
a'
Leg (16 req. - 1 pair per segment)
#2 - #9
Segment #10 (1 req.)
a
a'
a
a'
a
a'
Feeler
(2 req)
Fig.2
#10
Fig. 3

UNIT 13

FISH - FRESH-WATER

OBJECTIVES

1. Learning to use a microscope
2. Learning to take care of fish in an aquarium.
3. Learning about conservation of fish.

TERMS

Fins - appendages of fish made up of many bony spines covered by a thin fold of skin.

Pectoral Fins - located near the head, correspond to the front legs of land animals.

Pelvic Fins - in back of the pectoral fins, correspond to rear legs of land animal.

Dorsal Fins - along the top of the body. May be one or two.

Anal Fin - along bottom of trunk toward the rear.

Tail Fin or Caudal Fin - at the end of the tail

Cold-blooded - the temperature of their blood is the same as that of the surrounding water, and this temperature changes with the seasons.

Gills - breathing organs of fish, located on each side of the head.

Spawning - laying a very large number of eggs.

THINGS TO FIND OUT

1. What do fish look like? What are the three main parts of the body of a fish? (head, trunk, tail)
2. Where are fish found?
3. How do fish breathe? Where do they get oxygen?
4. How do fish swim?
5. What do fish eat?
6. How do fish reproduce?
7. Why are fish important to man?
8. How can we conserve fish?
9. Do fish hibernate?
10. If you were to watch a fish until its eyes closed, how long would it take?

ACTIVITIES

1. Set up a classroom aquarium.
2. Observe the fish in the aquarium. Note shapes and sizes of head, trunk, and tail regions. Identify the fins and see which ones are paired. Observe how the fish use their tails and fins. Watch the eyes and see if they move.
3. Remove a fish from the aquarium and wrap the fish in wet absorbent cotton, leaving only the tail exposed. Place the fish on a flat, glass dish and observe the tail under the microscope. If the fish flaps its tail, place a slide on the tail. Do not keep the fish out of the water for more than 15 minutes.
4. Obtain a small dead fish. Examine the gill covers, then lift them up to see the gills and the slits through which the water passes.
5. Dissect a fish and examine all its internal organs.
6. Look at fish scales under a magnifying glass or microscope. Count the number of curved lines or rays on each scale. Each ray represents a year's growth so you will be able to tell the age of the fish.

7. Obtain a copy of Wyoming fishing regulations. Discuss each one that pertains to conservation. Why do we have regulations?
8. Invite someone from the Fish and Game Commission to address the class.
9. Visit a fish hatchery. (Star Valley, Daniel, Jackson)
10. Grow brine shrimp to feed to fish.
11. Buy some canned roe so that the children can see and taste fish eggs.
12. Have children catch fish and cook them in class.
13. Breed guppies.
14. Make a fish rubbing. Directions are on pages 58-59 of Nature Craft by Richard F. Dempewolff, Golden Press.
15. Put one small fish into a bowl filled with some of the water it has been living in. Watch the fish as it opens its mouth to take in water. As it does so, put one drop of food coloring on the water right over the mouth. As soon as some of the colored water is taken into the fish's mouth, watch for it to come out from under the gill covers.

TEACHER'S RESOURCES

Stone and Stephenson: Science You Can Use
UNESCO: Source Book for Science Teaching
Victor, Edward: Science for the Elementary School
Wyoming Game and Fish Department: This is Your Game and Fish Department
Syrocki: Science, B. John: Science Activities for the Elementary Grades

CHILDREN'S REFERENCES BOOKS

Golden Nature Guide: Fishes (paperback)
Wyoming Game and Fish Department: Our Finny Friends
597W Woods, Loren P.: Fishes
Demplewolff, Richard F. Nature Craft - Golden Press
R500 Life Nature Library: The Fishes

Films

"These Fish Are Yours"

Wyoming Game and Fish Department
Box 378
Cheyenne, Wyoming 82001

Filmstrips

FS729	Life in Ponds, Lakes and Streams (about plant and animal life. Not much about fish) 1-6
FS732	Fresh-water Turtles and Fish 1-6
FS733	Keeping an aquarium

KOLab Resource Unit - Incubator I-1

Pamphlets

Pam T.A.	161 Turtox Service Leaflets
No. 23	Feeding Aquarium and Terrarium Animals
27	Brine Shrimp and Other Crustaceans
43	Aquarium Troubles: Their Prevention and Remedy
Pam T.A.	162
No. 9	The Fresh-water Aquarium

Miscellaneous

REA 25	Plastic Anatomy of Fish
REA 54	How Living Things Breathe (32 copies of photomicrographs to be used with microviewers) 4-6

Film Loops

FL24	Aquarium
FL27	Blood Circulation in a Goldfish Tail
FL32	Goldfish Eggs Hatching

UNIT 14

POND WATER

MATERIALS FOR COLLECTING POND WATER

White Enamel Pans
Large Collecting Jars (wide-mouthed pickle jars)
Nets (may be made from nylon stockings)
Spoons
Syringes
Droppers
Tin Cans
Tongs

MATERIALS FOR KEEPING POND WATER IN CLASSROOM

Tissue Culture Flasks (or small jars)
Living Laboratory (or large jars)

Begin unit with a trip to the pond at KOLab. While preparing for your trip, class may discuss what life might be found in the pond.

When you arrive at the pond, find a shallow place and look closely to see what may be observed. Are there any moving creatures? Look for algae floating on the water or growing on rocks and driftwood.

As you gaze into the pond think of it as an environment for living things. What effects do plants, animals, water, rocks and sun have on each other? What do we mean when we say that this is an "eat-and-be-eaten" world?

Now for the collecting: Divide the class into several groups, assign the equipment, and explain what each group is to do. Put some pond water into the white enamel pans and collecting jars. One group will use nets to scoop up water insects and algae.* These will be emptied into the white pans. Other groups will look for interesting specimens in the white pans and transfer them with spoons or droppers to the large collecting jars.

Return all unused pond water to the pond.

After the collecting jars have been brought back to the classroom, allow each child to keep a sample of the pond water in a tissue culture flask or small jar, such as a baby-food jar. Be sure that each culture flask has some algae in it. The remaining pond-water can be kept in a large covered jar or "living lab" in the classroom, to be observed for the remainder of the school year.

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*Scoop from top of water and from deeper parts. With tin can scoop samples of the bottom of pond.

THINGS TO FIND OUT

1. What is the very beginning of the food chain or what is the food of the very smallest creatures that live in the water.
2. What is the difference between a pond and a lake?
3. What are diatoms and why are they important to man?
4. Why are algae important to pond animals?
5. Why are algae important to man?
6. What would happen if all the plants in a pond were killed?
7. What is the slime you find in a pond?
8. What is the difference between algae and protozoa?
9. Do sponges grow in ponds? What are they?
10. What are some interesting ways in which some water insects move about?

ACTIVITIES

1. Make a chart of a simple food chain in a pond. (See Pam TA162 #17, or FS729 or FS1115).
2. Keep records of observations of tissue culture flasks.
3. Observe tissue culture flask under a microscope. Draw what you see.

4. Make slides of drops of pond water from the living lab to be used under the microscope. Sketch observation.

5. Observe pond insects with microprojector. Discuss and sketch.

6. Try to identify water insects. Copies of the Golden Nature Guide "Pond Life" should be kept in the classroom for reference.

7. Observe scum from pond under microscope. You should see brown and green materials. What are they?

8. Look at green algae through microscope. What unusual shapes do you see? Sketch and color them.

9. Observe as many water worms as you can find under a microscope. Can you identify them?

10. When observing insects, if they move too quickly to be easily observed, you may add a sticky substance such as a colorless syrup, to slow them down.

11. Catch some planarians. To attract the worms, use a two-inch cube of raw beef or liver tied with a string and dangled among water plants for an hour or so. When you pull in the meat, it will likely be covered with flatworms of various sizes and colors. (If you cannot catch specimens, you can buy them.) Watch how planaria move. What happens if you shine a flashlight on them in the dark?

12. Cut a planaria in half. What happens? Keep a daily record of observation for several weeks.

13. Make a water garden in a large jar or regular aquarium tank. Cover the bottom with about two inches of sand or gravel that has been washed clean under running water. Add rooted plants, taller ones at back, using clean stones to anchor roots. Add duckweeds or other floating plants. Place where light can shine through plants, but too much direct sunlight will cause overproduction of algae.

14. Make a bulletin board or scrapbook of the different kinds of algae and their uses.

15. Describe the life cycle of a dragonfly or mayfly. Make a chart of the different stages.

16. Draw the four stages in the life of a mosquito.

17. Using agar, inoculate and grow culture of pond water.

18. Grow cultures of pond water and tap water and compare the two.

19. Make slides of pond water and tap water and compare the two.

20. Obtain a hydra from pond water. Place in saucer using a medicine dropper with a wide tip. Add enough pond water to cover hydra. After hydra has relaxed and stretched, examine with magnifying glass. Note movement of tentacles. Tap the saucer with your finger or touch hydra with a pin. What happens? Place tiny bits of lean meat near hydra and watch the hydra eat. Look to see if any of the hydra are reproducing by forming buds. Cut a hydra in two or more pieces with a razor blade and place the pieces and pond water in a glass jar.

21. Have one of the children turn a handspring to illustrate how the hydra moves. The child's hands will serve as tentacles.

REFERENCES

Books

574 C	Science on the Shores and Banks, Cooper, Elizabeth
500 F	Wild Folk at the Pond, Fenton, Carroll
500 H	Let's Go to the Brook, Huntington, H.
	Pond Life, Golden Nature
R500 L	The Insects, Life Nature Library
578 C	Wonders Under a Microscope, Cosgrove, Margaret
	Science for the Elementary School, Victor, Edward
	Science Activities for the Elementary Grades, Syrocki, J.
RV17PW	KOLab Resource Unit - Pond Water

Pamphlets

Pam TA 161 #34	Care of Living Insect in the School Laboratory
Pam TA 162 #17	Life in a Pond
#26	Plankton Plants and Animals
Pam TA 58	Small Things (Investigation 6, Life in a Drop of Pond Water)

Film Loops

FL17	Raising Microscopic Animals
FL18	Microscopic Animals - Protozoa
FL19	Microscopic Water Animals (Good)

Filmstrips

FS729	Life in Ponds, Lakes and Streams 3-6 (Good)
FS730	Small Fresh-water Animals and Insects
FS1115	Animals of the Pond

Records

The Swamp in Spring

ALGAE

The simplest and oldest green plants belong to a group called algae. Common examples are pond scum and seaweed. They vary in size from plants several hundred feet long to others so small they can be seen only with a microscope. Algae are classified into groups according to color--blue, green, yellow, red or brown. They all contain **CHLOROPHYLL** and can make their own food. Some algae are independent one-celled plants that carry on all processes necessary for life. Many live in colonies of balls, long strands or sheets. All lack true roots, stems, or leaves.

Algae are the chief source of food for many of the animals that live in the water.

Because algae have chlorophyll and carry on photosynthesis to make their own food, they give off oxygen, which water animals need to live.

Seaweeds are used by man for fertilizing the soil. Algae are used in some parts of the world to make soups and gelatins. Algae are used in ice cream to make it smooth, and in salad dressing as a thickner. One kind of algae is used to make agar, which forms a jellylike material good for growing bacteria in hospitals and laboratories.

Algae may eventually be used in space flights. Because algae carry on photosynthesis, they are able to use the carbon dioxide that the passengers give off, and produce fresh oxygen. Because they grow so rapidly, there can always be a fresh supply on hand, to be strained out, dried, and then prepared for use as flour in baking or for use in soups.

ALGAE

Examine the scum from pond water. The green scum is called algae. One kind of algae feels very slippery; other kinds do not. Even without a hand lens, you can see that these algae are made up of what appear to be many green threads. With a hand lens, these green threads can be seen more clearly. They can be seen in even more detail with the microscope.

Under the microscope you can see that each green thread is made up of many little boxes, or cells. Each of the cells contains a little green coloring material. With the aid of sunlight, each cell makes food out of carbon dioxide and water. You will notice that these little green plants do not have stems, roots, or leaves.

The green algae plants which feel slippery are spirogyra. Like other threadlike algae, spirogyra is made up of a chain of cells that are attached end to end. Within each cell there is a long, flat, green ribbon which forms a spiral band from one end of the cell to the other. This green ribbon is what gives spirogyra its name.

Each cell of the spirogyra has a nucleus. The nucleus is very important to the cell. Scientists do not know all of the things the nucleus does for a cell. They do know, however, that only a few kinds of cells can live long without nuclei. Your own body is made up of different kinds of cells and nearly every kind has a nucleus.

The cells of spirogyra grow longer as the days go by. The long cells divide, each forming two cells. As more cells of the chain divide and grow, the chain itself becomes longer. Finally it breaks into pieces. Then there are two chains that continue to grow instead of just one. This also happens to the other threadlike, green algae.

Not all green algae are threadlike. Some are shaped like little boats; others are shaped like little balls; and still others are shaped like little crecent moons. Algae having these different shapes are much harder to see than are the threadlike, green algae.

UNIT 15

OCEANOGRAPHY

THINGS TO FIND OUT

1. Why is the ocean often called the "mysterious sea"?
2. What is oceanography?
3. How are ocean currents studied?
4. How do oceanographers go below the surface for observation?
5. How do men live under water for weeks?
6. What is the origin of the ocean?
7. Why is the ocean salty?
8. What is the temperature and color of the ocean?
9. What are currents?
10. What causes tides?
11. Why are tides important?
12. What causes oceanic currents?
13. How big are waves?
14. Does water move with waves?
15. What effect do waves have on the shoreline?
16. What is a tidal wave?

17. What are areas of ocean bottom?

18. What is the floor of the deep ocean like?

19. What lies on the bottom of the sea?

20. How deep is the sediment?

21. What type of life exists in the ocean, in the sea?

22. What food do we get from the ocean?

23. Is seaweed good to eat?

24. How will mining be done in the sea?

ACTIVITIES

1. Exploring the ocean
   Have the children read about the purpose and function of the different kinds of instruments used to study the ocean, and report some of the more pertinent findings made with these instruments. The recent reports of studies of the International Geophysical Year will supply interesting information about the topography of the ocean.

2. Seawater contains salt
   Pour some seawater in a saucer and let the water evaporate completely. Have the children taste the white crystals that were deposited in the bottom of the saucer. If seawater is unavailable , use salt water instead.

3. Icebergs
   Place a square or rectangular ice cube in a tumbler of water. Note how much of the ice cube is below the surface of the water. Collect and display pictures of icebergs. Point out that although the icebergs are huge, only about one tenth of the whole iceberg can be seen above the surface of the water.

4. Wind causes waves
   Pour some water into a large soup plate. Blow hard at one end of the plate across the water. The water will ripple and form waves. Blow harder and see what happens.

5. Locate the major ocean currents
   Obtain a map of the world and locate the major ocean currents. Trace their movements for both hemispheres.

6. The effect of the earth's rotation on ocean currents
Obtain a globe of the earth that can spin. Spin the globe very slowly in a counter clockwise direction. At the same time pour a small amount of fairly thick blue washable paint in a thin stream onto the north pole. As the stream flows down the northern hemisphere, it is deflected to the right by the earth's motion. When the stream crosses the equator and enters the southern hemisphere it is now deflected to the left. It can be made equally obvious that ocean currents moving north are deflected to the right and currents moving south are deflected to the left. This demonstration will help to show the children why the ocean currents have a clockwise circulation in the northern hemisphere and a counterclockwise circulation in the southern hemisphere.

7. Economic importance of the oceans
Let the children learn about the extraction of magnesium, bormine, and other chemicals in our daily life. Give reports of the commercial fishing industry and locate the important fishing areas of the world.

8. Winds help cause deep sea currents
Repeat learning Activity 4. Blow across one end of a large soup plate filled with water. Point out that the water moved away on the surface by the wind may be replaced by water below. This displacement helps create movement of water below the surface, producing a deep sea current.

9. Make a bulletin board of the depths of the ocean showing animal and plant life.

10. Plan an imaginary trip to the bottom of the sea--how will you go, what will you need to take and why are you going?

11. Make an ocean terrarium with plants, fish, etc.

12. Plan a food party using only food taken from the sea.

13. Pick an interesting animal of the sea such as the octupus, whale and tell how it needs the sea, what it eats, how it breaths, etc.

14. While listening to ocean sound records draw a picture of what you are seeing.

REFERENCES

Books

The Challenge of the Sea, Clarke 574.92 c55c, JHL
The Living Sea, Lambert 574.92 L178 JHL
The Living Sea, Cousteau 574.92 C83L, JHL
Diving for Science, Poole 574.92 P822, JHL
The Silent World, Cousteau 574.9 C83S, JHL
The Sea, Life Series, KEL
Oceanography, How and Why Wonder Book, KEL
Science for the Elementary School, Victor, KEL

Filmstrips

FS466	Mighty Currents of the Sea
FS467	Landscapes of the Sea

Transparencies

# 0-1	Ocean Currents
0-2	Earthquake Zones
0-3	Oceanographic Features
0-4	Coral Reef

Records

R515	Sounds in Waters of Varying Depths
R516	Sea at Castle Hill

UNIT 16

LIGHT

THINGS TO FIND OUT

1. Is light a form of energy?
2. Do light waves travel faster than sound waves?
3. Is light made up of many colors?
4. Do we see colors in light?
5. What is "white" light?
6. Find the different types of lights: candle, oil, lantern, gas, electricity.
7. What two kinds of electric lights are found in most houses?
8. What are neon signs made of?
9. What are vapor lights made of?
10. What are some of the laser light uses?
11. What is "invisible" light?
12. How does light effect man, animals, plants?
13. Does light travel in straight lines?
14. What is the main source of earth's light?

TERMS

Color Wheel - a circle of primary and (intermediate) spectrum color

Electric Eye - a device in which light produces electric current.

Invisible Light - light that cannot be seen by the human eye, such as ultraviolet or infra-red light.

Florescent Bulb - a glass tube coated on the inside with a substance that gives off light.

Incandescent Bulb - the light bulb in common use that screws into a socket.

Laser - a device that produces a thin beam of strengthened light.

Neon Light - gas-filled tubes which are made to give off colored light. The color depends upon the gas that is used.

Primary Colors - red, yellow and blue.

Prism - a wedge of glass used to "bend" light and form a spectrum.

"White" Light - a mixture of many colored lights. Light from the sun is such light.

ACTIVITIES

1. Seeing in the dark. Take five sheets of white paper. Roll them into a hollow tube. Slip a rubber band around the roll of paper. Put tube on page of school book and press one eye against the top of the roll. Try and read it in the dark.
2. Mix primary colors to show what colors will be produced.
3. Give children pieces of colored cellophane (red, blue and yellow). Let them look at the children's clothes in the school room and see how the colors are changed.
4. Make a color spectrum by using a prism.
5. Use colored chalk to mix primary colors.
6. Tell favorite colors.
7. Collect pictures from magazines to show where color makes things look good or look bad.
8. Find how color is used in signs.

9. Find the uses of color in the protection of man and animals.

10. Use small pieces of green, yellow and red paper and put these on larger pieces to see which colors go together better and show better.

11. Make a peek-box. Use a shoe box and put colored cellophane on top and sides and make a scene of story inside the box.

12. Make a disk with the primary colors on it. Make two holes in center and run a cord through the holes and tie the ends together. Spin the disk.

13. Make a shadow picture of the students.

14. Make disks with colors and lines and put on small motor and see what optical illusions are produced.

15. Plant peas in 4 large glass bottles and put different colors of cellophane around bottles to see effects of light on plants.

16. Put flashlight over hand and behind ear to see if light goes through things. Also use paper, clothing, table and other objects in the room.

17. Make a shadow by suspending a styrofoam ball between lamp and screen, moving the ball away from the lamp and creating a different shadow.

18. Measurement of light by the use of a lightmeter.

19. Speed of light - Read and report on the speed of light.

20. Show how light travels in straight lines, by setting up four index cards with holes in a straight line with each other. Place a flashlight to shine directly through the holes. Move a card so it is out of line. The child will not be able to see the light.

21. Make a torch. Unesco Source Book for teaching Science.

22. Construct a smoke-box. Unesco Source Book for Teaching Science.

23. Make a pinhole camera (p. 27-Pam. Experiences with Light and Color). p. 191 Unesco Science.

24. Make a card with a bird on one side and a cage on the other side. Twirling the card makes the bird seem to enter the cage.

25. Make a model periscope p. 194, Unesco Source Book for teaching Science.

26. Make rough lenses from bottle bottoms p. 197-Unesco.

27. Many experiments and materials for study of light - p. 191 - 205, Unesco Source Book for Science Teaching.

28. Sprinkle bird seed mix on a wet sponge or cotton. Experiment with light control in different parts of the room. Experiment can last several weeks until "harvest."

29. Plant seeds (beans or peas) and see which way the plants will go setting in a window. May mark on carton the direction the plant will grow.

30. Put a plant in a box with a window and see what the plant will do.

31. Why Night is Dark, p. 117, Easy Science Experiments

32. The Silver Egg, p. 118, Easy . . .

33. The Broken Pencil, p. 120 Easy . . .

34. Why the Sky is Blue, p. 122 Easy . . .

REFERENCES

Light, KOLab RU, 8L LMC - Teachers Guide

Film Loops

F122	Colors Are Useful K-6
F23	Nature's Use of Color

Film Strips

FS182	Physical Optics - Light Waves
FS340	The Science of Color
FS771	Light and How it Travels
FS772	Light and Color
FS938	How We See
FS939	The Story of Lenses

REA 2 Color Kit (With filmstrips, 7 frames each)
For explanation of the primary colors, red, blue, yellow, and green.

Optical Illusions Kit - Junior High - Motor and disks

Teachers
Energy
Life Science Library

References

Books

Science You Can Use, Stone and Stephenson, p. 190-224.
Science Activities for the Elementary Grades, Syrocki, John, p. 110-113.
Light and Shadow, Tannenbaum and Stillman
True Library - Vol. 1-10
Light and Vision, Life Science Library
Science Teaching Today VII, (Experiences with light and color)
Source Book for Science Teaching, Unesco (Optical Illusions) p. 207

UNIT 17

ELECTRICITY

THINGS TO FIND OUT

1. What is electricity?
2. What are some of the ways we know of to make electricity?
3. What makes the generator spin around?
4. How does a transformer help us get electricty to our homes?
5. Why is copper most commonly used for electrical wiring?
6. What happens when a magnet moves inside a coil of wire?
7. How is a switch like a door?
8. What are some of the safety rules we must obey when using electricity?
9. How many ways can we use dry cells?
10. Why is it called a dry cell?
11. What is a storage "battery"?
12. What are the two liquids used in a storage battery?
13. Why is a fuse called a policeman?
14. What is static electricity?

15. What is an electric current?

16. What kinds of things conduct electricity?

17. Why do some electrical devices "give off" light and heat?

18. What particles compose matter?

19. How is matter constructed?

TERMS

Electricity - A form of energy

Energy - The ability to move things and do work.

Atoms - Made of small particles called protons, neutrons and electrons.

Current Electricity - Moving electricity. The electrons are flowing, being passed from atom to atom. Does most work for man.

Conductors - Materials that electrons can flow through. Copper is a better conductor of electricity than iron.

Volts - Scientists measure electrical pressure in units called volts.

Insulators - Poor conductors of electricity .

Amps - The flow of electricity is measured in units called amperes.

Circuit - Electricity must be able to flow around and around. The path it follows is called a circuit.

Short Circuit - Causes fires and sometimes happens in a frayed cord when two bare wires touch.

Static Electricity - Produced by friction

ACTIVITIES

1. Make a simple homemade motor - p. 132-135, Energy Life Science Library.

2. Make an electric switch - Experiment Board p. 7, Science Bulletin. Teaching Electricity with Electric Trains.

3. Make unusual switcher - back pages, Science Bulletins.
4. Electricity can be obtained by rubbing things together.
5. P. 164, UNESCO Source Book for Science Teaching.
6. How to make Paper Jump, p. 165 UNESCO
7. Sparks from Rubbing, p. 165 UNESCO
8. The Balloon Stays Put, p. 165 UNESCO
9. The Newspaper Stays on the Wall, p. 165 UNESCO
10. There are two kinds of static charge, p. 165-166 UNESCO
11. How to make a Pith Ball Indicator for Static Charges, p. 166 UNESCO
12. Metal Foil Ball Electroscope, p. 166 UNESCO
13. How to make an Electroscope from Newspapers, p. 166 UNESCO
14. Fun with a Kissing Balloon, p. 167 UNESCO
15. More Fun with a Balloon, p. 168 UNESCO
16. Show How Electricity Flows in a Conductor, p. 168 UNESCO
17. Another Way to Show How Electricity Flows, p. 169 UNESCO
18. How to Make Simple Instruments to Show Electric Currents, p. 169 UNESCO
19. Using a Dry Cell in a Circuit, p. 171 UNESCO
20. Flashlight Bulbs Holders, p. 171 UNESCO
21. How a Flashlight Works, p. 171 UNESCO
22. How Cells are Connected, p. 172 UNESCO
23. How Lamps are Connected, p. 172 UNESCO
24. How to Make a Simple Switch, p. 173 UNESCO
25. How We Get Heat and Light from Electricity, p. 174 UNESCO
26. How Fuses Protect Electric Circuits, p. 174 UNESCO

27. How a Short Circuit Burns Out a Fuse, p. 174 UNESCO

28. How to Make a Simple Fuse Holder, p. 174 UNESCO

29. Telegraph Sender and Receiver, p. 68 Science Activities

30. What Kinds of Things Conduct Electricity? p. 270-271 The Teaching of Science in the Elementary School.

31. Why Are Electric Wires Covered? p. 273 The Teaching of Science in the Elementary School.

32. The Door Buzzer and Doorbell, p. 278-279 The Teaching of Science in the Elementary School.

33. Many Types of Different Currents in Electricity p. 277-279 and 281-282 The Teaching of Science in the Elementary School

34. Have children list some of the electrical devices they have in their homes that "give off" heat and light.

35. Make an electric question and answer tester, p. 289 The Teaching of Science in the Elementary School.

36. Visit UPL power plant.

37. Make a simple generator of electricity, p. 295 The Teaching of Science in the Elementary School.

38. Bring an electric train and set it up in the room.

39. Locate where wires from street enter homes or school.

40. Locate fuse box and find which fuses control certain areas of home or school.

41. Locate master switch.

42. List dangers practices in connection with use of electricity.

43. Locate nearest substation and transformers.

44. List uses of electricity in home and school.

45. Examine a light bulb and thin wire used for light.

46. Examine an old toaster and note thickness of wire used for heat.

47. Examine a dry cell cut apart.

48. Make a list of things using dry cells.

49. Discuss the fact that recent development of nuclear energy has come about as a result of the study of electricity.

50. Take apart some old appliances, examine wiring, heating units, how circuits are completed.

51. Make a report on the importance of electricity in our world (light our homes, streets at night, carrying messages, entertainment, running great factories, etc.)

52. Read about men instrumental in the development of electricity.

53. Make a heating element.

54. Discuss the storage batteries used in cars and what they do.

55. Discuss what happens when there is not water power to turn the generators.

56. Use a simple windmill to prove that wind has the power to generate electricity.

57. Examine some electric motors.

58. List some electric motors we might find in our homes.

59. Examine the insides of a clock.

60. Many activities in Science for the Elementary School, Victor, Edward p. 738.

61. Magic Comb, p. 89 Easy Science for the Elementary School.

62. Electric Sparks, p. 92 Easy Science for the Elementary School.

63. A Simple Battery, p. 96 Easy Science for the Elementary School.

64. Many activities in Science You Can Use, p. 77-112.

65. Make a chart of using electricity safely.

66. Have a person from the electric company come in and talk about electric meters, kilowatts, safety, etc.

REFERENCES

Teacher's Books

Energy, Life Science Library
Electricity, The How and Why Wonder Books, Grosset & Dunlop
Elementary School Science Bulletin No. 58, Dec., 1960
Teaching Electricity with Electric Trains
Source Book for Science Teaching, UNESCO
Science Activities for the Elementary Grades, Syrocki, J.
The Teaching of Science in the Elementary School, Lewis, June and Potter, Irene
Science for the Elementary School, Victor, Edward
Easy Science Experiments, Kleenman, Louis
Science Teaching Today, Vol. 5 (Experiences with Magnetism and Electricity).
Elements of Electricity, Navarra, John & Gerne, Timothy
Science You Can Use, Stone and Stephenson

Children's Books

Electricity, Victor, Edward - Follett Publishing Co.
The How and Why Wonder Book Series

R500	Atomic Energy
R500	Electricity
R500	Science Experiments
R500	Beginning Science

Filmstrips

FS164	Elements of Electrical Circuits
FS165	Series and Parallel Circuits
FS166	Home Electrical Appliances (3-6 detailed description and diagrams, old black and white)
FS180	Electro-Magnetic Radiation (5-6, color, good)
FS787	What is Static Electricity
FS788	What is Current Electricity
FS789	How Most Electricity if Produced
FS790	Producing Small Amounts of Electricity
FS791	Electromagnets and How They Work
FS792	How is Electricity Used in the Home?
FS793	Using Electricity Safely (2-6, good, color)

Transparencies

OHT262	Magnetism and Electricity

UNIT 18

MAGNETISM

THINGS TO FIND OUT

1. What is a magnet?
2. Name two kinds of magnets.
3. What is the name of the invisible something that enables magnets to pull or push?
4. How did magnetism get its name?
5. Explain the relationship of iron ore and "magnetite".
6. What are magnetic poles?
7. Explain the Law of Magnetic Poles.
8. How can you cause magnets to float in air?
9. Name five magnetic materials.
10. How does a vending machine reject slugs? (a vending machine is one which contains candy, pop, ice cream, etc. and a coin slot).
11. What is a magnetic field?
12. Can magnetism pass through materials, such as , a pile of metal on the other?
13. What is the smallest magnet?
14. You may have seen a watch advertised to be non-magnetic.
15. What materials would a person need in order to make a magnet?

16. What is meant by a "permanent" magnet?

17. How would a magnet be "demagnetized"?

18. In what instruments (used in finding directions, etc.) would you find a magnet?

19. How is a compass used?

20. How do prospectors use magnetism to find ore?

21. What causes the aurora borealis or "northern lights"?

22. There is a great swarm of radioactive particles above the earth which resembles a doughnut. This is thickest above the earth's equator where the earth's magnetic field is the weakest. What is the name of this "magneto-sphere"?

23. What is an electromagnet?

24. Name the materials needed to make an electromagnet?

25. How are electromagnets used in everyday living?

26. What is a "dynamo"?

27. Explain the parts which make up an electric motor, and how it uses magnets.

28. Explain the use of magnets in atomic research.

29. Magnets are used in telegraphs, telephones, radios, and television. Choose one of these instruments and fully explain the workings of a magnet in the instrument you have chosen.

30. In the near future, how do you think magnets will be used in connection with atomic research and outer space?

TERMS

Magnets - materials that will pick up or attract materials made of iron, steel, cobalt, and nickel.

Lodestones - natural magnets found in the ground.

Poles - the ends of magnets. A man-made magnet always has two poles: a north-seeking pole and a south-seeking pole.

Magnetic Field - space around which the force of a magnet acts or is felt.

Electromagnet - a temporary magnet made by wrapping an insulated wire many times around a piece of soft iron and then connecting the bare ends to the posts of a dry cell.

Static Electricity - electricity that does not move.

Current Electricity - electricity that moves.

Conductors - materials that allow electrons to move or flow easily through them.

Insulators or Nonconductors - materials which will not allow electrons to move easily through them.

Lightning - a huge electric spark produced by static electricity.

Compass - an instrument which tells us where the direction north is.

ACTIVITIES

1. Making an electromagnet
   Materials: Dry cell, wire, switch (toggle), large nail or bolt, small nails or paper clips
   Procedure: Wind about ten turns of wire around the large nail or bolt. Strip the insulation from the ends of the wire. Connect one end of the wire to one terminal of a dry cell, and the other end to a terminal of the switch. Prepare a second wire. Connect this wire to the other terminal of the dry cell and the other end of the switch. Now close the switch, and try to pick up paper clips or small nails with the large nail or bolt. Open the switch, and the small nail or clips will fall.
   Results: The electricity from one part of the dry cell flows through the many turns of wire back into the dry cell. When electricity flows through a wire, the wire has magnetic power around it. The more times wire is wound around the nail, the stronger the magnetism. The iron nail or bolt inside the coil becomes a magnet only so long as the electricity is flowing in the circuit.

2. Testing the polarity of an electromagnet
   Materials: Electromagnets you have made, switch (toggle) insulated copper wire, dry cell, magnetic compass.

Procedure: Connect you electromagnet to a dry cell and a switch. Bring a magnetic compass near one of the poles of your electromagnet. Close the switch. What happens to the needle of the compass? Which pole of the compass was attracted to the pole of your electromagnet? Move the compass near the other pole of the electromagnet. Close the switch again. What happens this time?
Results: We know that the opposite poles of a magnet (north and south) attract each other. Like poles (north and north, south and south) repel each other. You can tell which pole is which by testing with a magnetic compass. Try to determine the polarity of your electromagnet. What do you think would happen if you reversed the two wires connected to the dry cell? Do you see how magnetism and electricity are related? Our magnet really depends on the electricity it gets from the dry cell.

3. Finding the magnetic lines of force
Materials: Magnet, sheet of stiff paper (thin cardboard or a thin plate of glass can be used), teaspoonsful of iron filings.
Procedure: Put a magnet on a table and place your sheet of stiff paper so that it rests upon the magnet. Sprinkle the iron particles slowly and evenly upon the paper, covering the area just above, and for two or three inches on all sides of the magnet. Then, tap the paper lightly several times with a pencil point in order to make certain that the iron particles are spread evenly.
Results: Depending on the type of magnet you are using, the iron filings will arrange themselves in certain patterns. Lines of iron particles will radiate outward from both poles of the magnet. We say that these particles are arranged along "lines of magnetic force". Try the same experiment placing the north and south poles of two magnets half an inch to an inch apart; now the lines of magnetic force arrange the iron particles as in a third experiment, place like poles near each other. In all three experiments the iron particles are thickest at the poles of a magnet.

4. Get a steel knitting needle. Make it into a magnet by stroking it about fifty times in the same direction. Dip it into iron filings.

5. Lay a bar magnet flat on a table. Put a piece of heavy cardboard on top of it. Sprinkle iron filings on the cardboard. Tap the cardboard. Look at the pattern.

6. Make the head of a hammer into a magnet by stroking it with a strong magnet.

7. Make a Magnetic Duck, p. 21-22 Magnet, Parker, Bertha.

8. Make a Homemade Compass, p. 23, Magnets, Parker, Bertha.

9. Make an Electric Magnet.

10. With an electric magnet, find out how many nails it will pick up when connnected to a cell. Now use two cells and find out how many it will pick up. Do not use more than two cells.

11. Build a toy derrick. Fasten a little electric magnet to it. Use the derrick and magnet to move nails from one place to another.

12. Find things a magnet will pick up.

13. Find things a magnet will not pick up.

14. Place a magnet under the table and see if objects move.

15. Place a magnet under paper and see if objects move.

16. Place a magnet under glass and see if objects move.

17. Make an electromagnet, p. 8, Experiences with Magnetism and Electricity.

18. Find different kinds of magnets.

19. Make a floating compass, p. 85, Science Activities for the Elementary Grades.

20. Make one magnet form another one.

21. Show how the earth acts as a magnet, p. 14, Experiences with Magnetism and Electricity.

22. Some unusual experiments with magnets, p. 16-18, Experiences with Magnetism and Electricity

23. Paper Magnet, p. 90, Easy Science Experiments.

24. How to Make Bar Magnets, p. 156 UNESCO.

25. How to Make a Turntable Cradle for Magnet Study, p. 156 UNESCO.

26. Do Magnets Act Through Space? p. 157 UNESCO.

27. Making Simple Compass Needles, p. 157 UNESCO.

28. A Razor Blade Compass Box, p. 258 UNESCO.

29. To Determine Magnetic North, p. 158 UNESCO.

30. How to Make a Dip Circle, p. 259 UNESCO.

31. Try picking up paper clip with the ends of a bar magnet. Repeat using a V magnet.

32. Using several magnets, test them to find which magnet is the strongest.

33. Use two bar magnets to show that one magnet will both push and pull the other magnet.

34. Tie a string around a bar magnet and suspend from the doorway. Observe that the magnet will stop in a north-south position.

35. Examine the inside of a doorbell, noticing the coiled wires.

36. How can an electromagnet be made stronger and controlled.

37. Show how magnets can lose their magnetism, p. 742, Science for the Elementary Schools.

38. Make a simple telegraph, p. 744, Science for the Elementary Schools.

REFERENCES

Books

Science Curriculum Guide for Elementary Grades, Lesson 57 Magnets, Parker, Bertha Morris
Science Activities for the Elementary Grades, Syrocki, John
Science Teaching Today, Vol. 5 Experience with Magnetism and Electricity.
Easy Science Experiments, Kleinman, Louis W.
Source Book for Science Teaching, UNESCO
The Teaching of Science in the Elementary School, Lewis, June E. and Potter, Irene C.
Models for Electric and Magnetic Interaction, Berger, Coffman, and Davis
Science for the Elementary School, Victor, Edward

The How and Why Wonder Book Series

R500 Magnets and Magnetism
R500 Science Experiments
R500 Beginning Science

Film Strips

FS471	Earth's Magnetism (4-6 Color, Good)
FS509	Discovering Magnets
FS510	Different Kinds of Magnets
FS511	Magnets Help to Find Direction
FS512	Magnets Can Attract Thru Objects
FS513	What is Magnetism?
FS514	Magnetic Fields (K-4 Color, Good)

Transparancies

OHT42	Magnetism and Electromangnetism

KOLab Resource Unit - Compasses

Explore the magnetic field

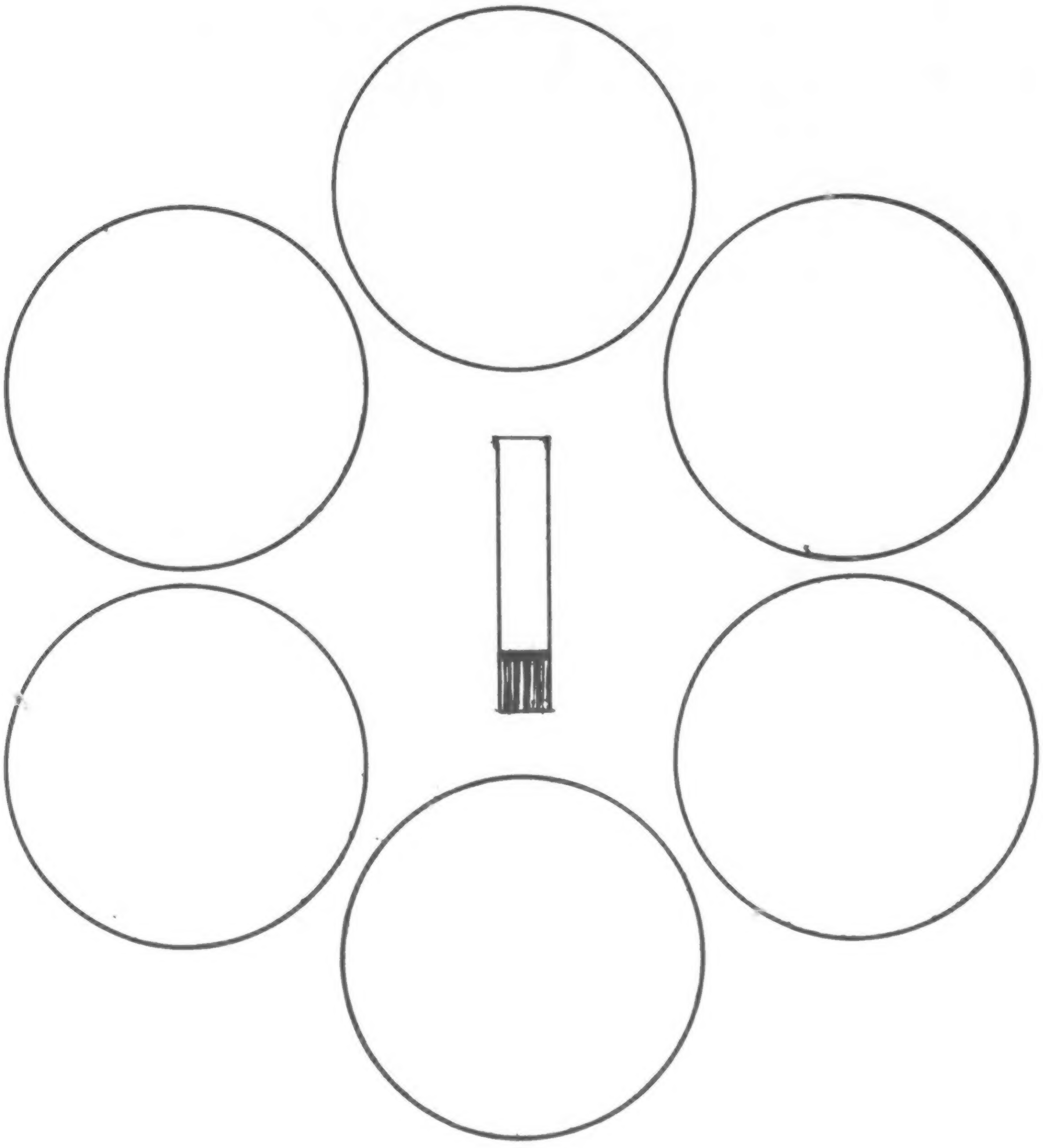
Put your manual on a level desk or table.

Tape a magnet to the outline.

Set the compass in a circle on the page and observe the direction of the needle when it stops.

Pick up the compass and draw an arrow in the circle to show the direction of the needle.

Do the same for the other circles.



What did you find out about the magnetic field and the magnetic poles?

____

____

Leave your magnet taped to this page.

The Magnetic Field

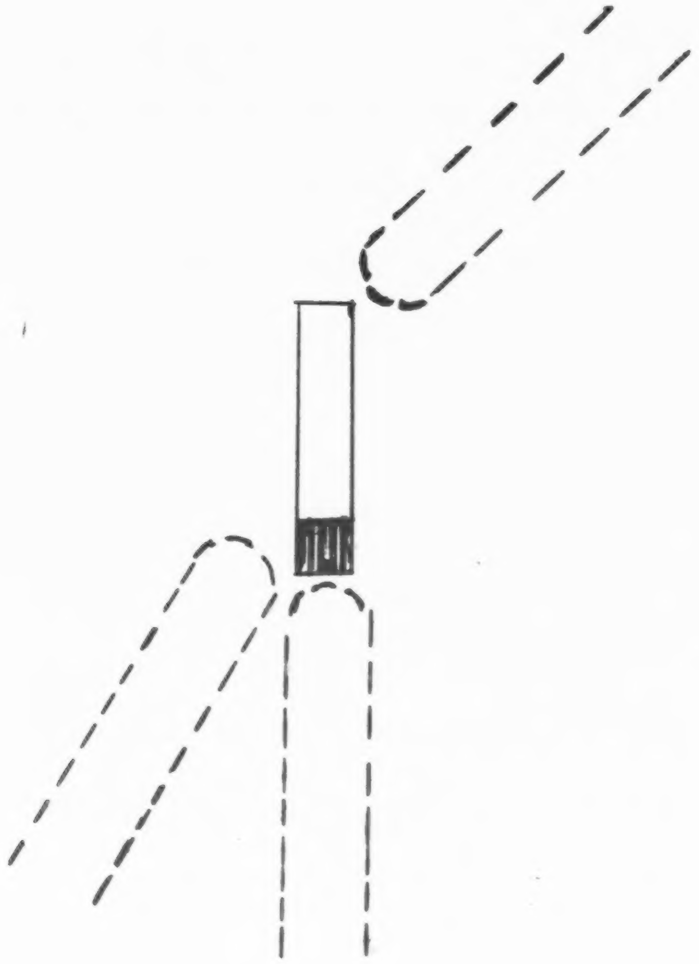
Explore the magnetic field.

Put your manual on a level desk or table.

Tape a magnet to the outline.

Put another magnet into the test tube.

Hold the test tube in various positions near the magnet on the page and look for evidence of interaction - at - a - distance.



What did you find out about the magnetic field and the magnetic poles?

____

____

____

UNIT 19

WEATHER

OBJECTIVES

1. Learn what causes different kinds of weather.
2. Learn to read and interpret weather.
3. Learn to predict weather.
4. Learn to read and construct maps and graphs.

THINGS TO FIND OUT

1. What makes weather?
2. Can you see air?
3. Does air take up space?
4. Is air heavy?
5. Does air push in all directions?
6. Is air lighter on a mountain or in a valley?
7. Why is it colder on a mountain than in a valley?
8. Is a winter day longer or shorter than a winter night?
9. Why do the sun's rays give less heat in winter?
10. What happens to air when it is heated?
11. Where is the warmest part of a room?
12. When does air move fastest?

13. Why does wind blow?

14. What happens when water dries up?

15. What causes evaporation?

16. What makes your window cloud up?

17. What is a cloud?

18. When and how does dew form?

19. What is frost?

20. Why does it rain?

21. What is snow?

22. What are hailstones?

23. What causes lightning?

24. What causes thunder?

25. What are hurricanes? Where do they come from?

26. What is a rainbow?

27. What are cumulus, cirrus, stratus, and nimbus clouds?

28. What are the effects of heat, pressure, wind, and moisture?

29. What are air masses?

30. What are highs and lows?

31. How are fronts formed? How do they move and change?

32. How do storms develop? What are thunderstorms, tornadoes and hurricanes?

33. How is information plotted and charted on a weather map?

34. How do you make your own forecast?

35. What are rain, snow, dew and frost?

36. Why is weather knowledge important to farmers, fisherman, navigators, pilots, and to some industries?

37. What is the difference between climate and weather?

ACTIVITIES

1. Record daily temperatures on a wall chart or individual graphs.

2. Primary children may record the weather daily by placing a picture denoting sun, rain, wind, snow, etc., on a calendar.

3. Use wall pictures to illustrate different types of clouds.

4. Collect pictures showing various cloud formations for a bulletin board.

5. Visit the weather station at KOLab and have person in charge explain the instruments.

6. Build a weather-station, making all your own instruments or using commercial instruments, especially the thermometer and barometer.

7. Have children watch weather reports on TV and report to class.

8. Have children bring in weather maps from newspaper.

9. Forecast the weather and check your forecasts with KOLab or local radio station. Check your predictions to see how accurate they have been.

10. Do research and write a paper on the various kinds of storms, such as thunderstorms, hurricanes, tornadoes, typhoons, etc.

11. Collect weather sayings and proverbs: Which ones are based on scientific principles?

12. Use "Studying Weather in the First Grade" p. 112 of the National Elementary Principal, Science for Today's Children.

Excellent activities and science experiments can be found in the following books:

UNESCO	Source Book for Science Teaching
R500B	Bonsall, George Weather (How and Why Wonder Books) Kleinman, Louis Easy Science Experiments Victor, Edward Science for the Elementary School National Elementary Principal Science for Today's Children

For recording the weather, the class should make the following instruments:

a. Thermometer - to measure temperature

b. anemometer - to measure wind speed (this is difficult and sometimes unsuccessful). The wind table may be substituted.

c. weather vane - to show direction of wind

d. barometer - to measure air pressure

e. hygrometer or wet - dry bulb thermometer - to measure humidity. The wet - dry bulb seems more successful. You will need a chart to interpret your readings on wet - dry bulb.

f. rain - gauge

Directions for making all of above instruments may be found in UNESCO Source Book for Science Teaching and Science for the Elementary School by Edward Victor.

Directions for a housing box for weather instruments are on p. 96 of UNESCO Source Book for Science Teaching.

WEATHER FORECASTING:

Only a small part of the weather forms locally. Most of our weather comes from distant places. This is why weather maps are needed to forecast weather very accurately or far ahead.

However, you can tell something about the weather by observing it locally. The barometer, sky, and wind give you your best clues. The children should have some knowledge of the various types of clouds. Material on cloud formations and weather predicting will be included at the end of this unit.

REFERENCES:

UNESCO Source Book for Science Teaching
R500B Bonsall, George Weather (How and Why Wonder Books)
Kleinman, Louis Easy Science Experiments
Victor, Edward Science for the Elementary School

551.5	Spar, Jerome The way of the Weather
551 P	Parker, Bertha Clouds, Rain and Snow
536 P	Parker, Bertha Thermometers, Heat and Cold
	Lehr, Burnett, Zim Weather (Golden Nature Guide)
	Life Science Library Weather
	Syrocki, John Science Activities for the Elementary Grades
	National Elementary Principal Science for Today's Children
574	Julian, May Climate
551 P	Palmer, Woods Jr. Air and Water
551 P	Preston, Edna Mitchell Air
R500 B	Keen, Martin L. Science Experiments
	Lewis and Rotter The Teaching of Science in the Elementary School
	Hubbell, Lawrence The Earth

Film Strips

FS55	Atmospheric Pressure 5-6
FS57	Barometers and the Weather - Explanation of mercury and aneroid barometers, weather map highs and lows forecasting 4-6
FS237	Temperature 4-6
FS244	Humidity 5-6
FS461	The Canopy of Air - Gases that make up atmosphere, air pressure, wind, clouds Good 3-6
FS468	The Mystery of Rain 4-6
FS469	Maelstroms of the Air - Air current, forecasting and controlling storms 4-6
FS505	The Sun and Our Seasons - Good for seasons, not weather 2-6
FS506	What Is Weather? - Very good 1-4
FS507	What Makes the Weather? - Very good 2-6
FS508	Climate - Very good 2-6
FS526	Atmosphere and Its Circulation 5-6
FS527	Weather - Explains weather instruments, solar radiation, polar front theory 4-6
FS743	How Does Water Get Into the Air? - Simple experiments v.g. K-3
FS744	What Makes Things Dry Faster? K-3
FS745	Where Do Clouds Come From? K-3
FS746	What Is Wind? K-3
Fs747	Why Is the Night Cooler Than the Day? K-3

Pamphlets

Pam. Ta 146 Canopy of Air (No. 37 L.R.)

Transparencies

OHT24	Water, Air, and Heat
OHT35	Earth Science: Weather (Jr. High)
OHT53	Weather

SCIENCE

NAME ____________________

TYPES OF CLOUDS

HIGH CLOUDS

1. Cirrus clouds, wispy, and feathery, are composed entirely of ice crystals. Sometimes called "Mares' Tails."

2. Cirrocumulus clouds thin, patchy clouds often form wavelike patterns. They are often rippled and always too thin to show shadows.

3. Cirrostratus clouds form in thin sheets that look like fine veils or torn, wind-blown patches of gauze. They form large halos or circles around the sun and moon.

MIDDLE CLOUDS

1. Altostratus clouds are dense veils or sheets of gray or blue. They appear lightly striped.

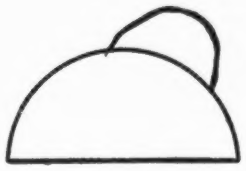
2. Altocumulus clouds are patches or layers of puffy or roll-like clouds, gray or whitish.

LOW CLOUDS

1. Stratus is a low, quite uniform sheet, like fog, with the base above the ground. Dull-gray in color.

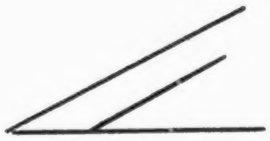
2.	Nimbostratus	are the true rain clouds. Darker than ordinary stratus, they have a wet look, and streaks or rain often extend to the ground.
3.	Stratocumulus	are irregular masses of clouds spread out in a rolling or puffy layer. Gray with darker shading.
4.	Cumulonimbus	are the familiar thunderheads. In their most violent form these clouds produce tornadoes.
5.	Cumulus	are puffy, cauliflower-like. Shapes constantly change. They mean fair weather unless they pile up into cumulonimbus.
6.	Cumulus and Cumulonimbus	are both clouds of upward development, unlike the layered clouds described above.

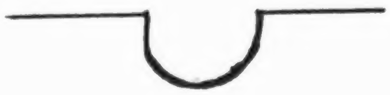
CLOUD SYMBOLS



CUMULUS

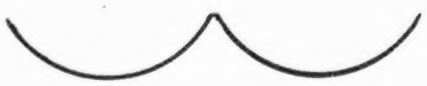
ALTOSTRATUS

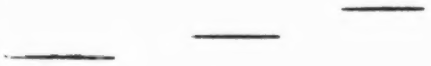




STRATOCUMULUS

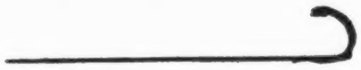
ALTOCUMULUS

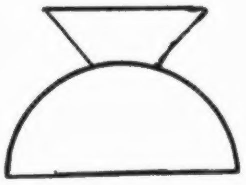




STRATUS

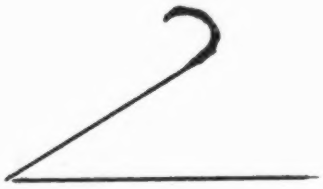
CIRRUS

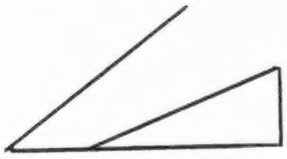




CUMULONIMBUS

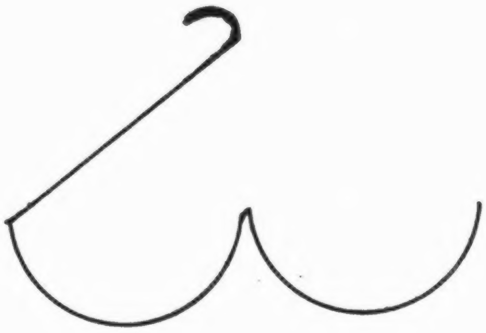
CIRROSTRATUS





NIMBOSTRATUS

CIRROCUMULUS



WEATHER SIGNS

WEATHER WILL GENERALLY REMAIN FAIR WHEN:

The wind blows gently from west or northwest
Barometer remains steady or rises
Clumulus clouds dot the summer sky in the afternoon
Morning fog breaks or "burns off" by noon

RAINY WEATHER OR SNOW MAY COME WHEN:

Cirrus clouds thicken and are followed by lower clouds (particularly true if barometer is dropping)
There is a ring around the moon
Puffy cumulus clouds begin to develop vertically
Sky is dark and threatening to the west
Southerly wind increases in speed with clouds moving from west
The wind--particularly a north winds--shifts in a counterclockwise direction--that is from north to west to south
The barometer falls steadily

WEATHER WILL GENERALLY CLEAR WHEN:

Bases of clouds show steady rise to higher types
The wind--particularly an east wind--shifts to the west
The barometer rises rapidly

TEMPERATURE WILL USUALLY FALL WHEN:

Winds blow from--or shift to--north or northwest
Night sky is clear and wind is light
The barometer rises steadily in winter

TEMPERATURE WILL USUALLY RISE WHEN:

Wind is from, south particularly with cloud cover at night or clear sky during the day.

WEATHER

WIND DIRECTION	BAROMETRIC PRESSURE	GENERAL FORECAST OF WEATHER
SW to NW	30.10 to 30.20--barometer steady	Fair, with little temperature change for one to two days
SW to NW	30.10 to 30.20--rising rapidly	Fair, with warmer weather and rain within two days
SW to NW	30.20 or above--barometer steady	Remaining fair with little temperature change
S to SE	30.10 to 30.20--falling slowly	Rain within 24 hours
S to SE	30.10 to 30.20--falling rapidly	Rain within 12 to 24 hours. Wind will rise
SE to NE	30.10 to 30.20--falling slowly	Rain within 12 to 18 hours. Wind will rise
SE to NE	30.10 to 30.20--falling rapidly	Rain within 12 hours. Wind will rise
SE to NE	30.00 or below--falling slowly	Rain will continue one or more days
E to NE	30.00 or below--falling rapidly	Rain with high winds in few hours. Clearing within 36 hours--colder in winter
E to NE	30.10 or above--falling slowly	Summer, with light winds: rain in two to four days. Winter, rain or snow within 12 hours
E to NE	30.10 or above--falling rapidly	Summer: probably rain in 12 or 24 hours. Winter: rain or snow within 12 hours
S to SW	30.00 or below--rising slowly	Clearing within a few hours. Then fair for several days
S to W	29.80 or below--falling rapidly	Severe storm within few hours. Then clearing within 24 hours --colder in winter
E to N	29.80 or below--falling rapidly	Severe storm (a "nor'eastern" gale) in few hours. Heavy rains or snowstorms Followed by cold wave in winter
Swinging to	29.80 or below--rising rapidly	End of storm--clearing and colder

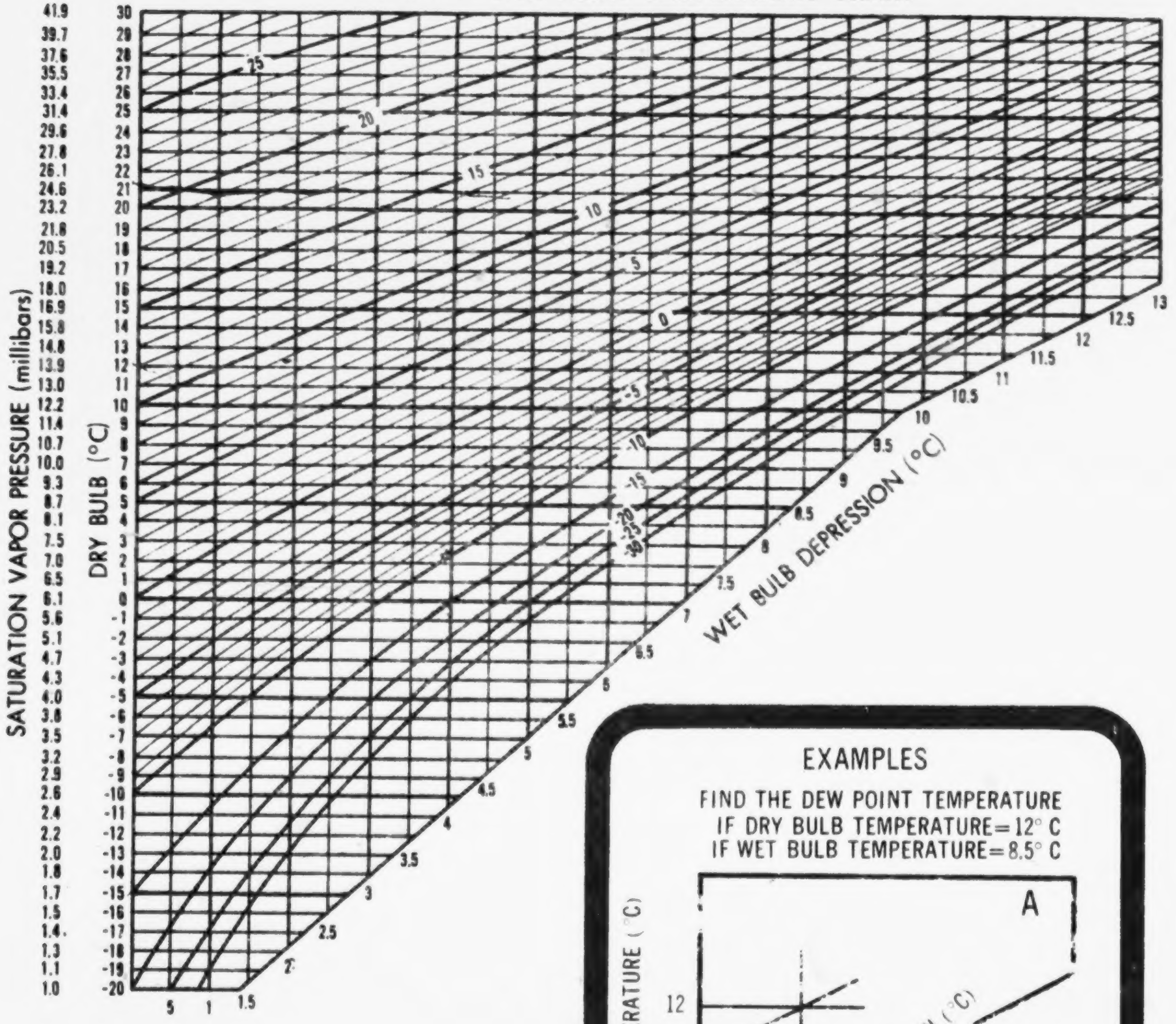
WEATHER

NAME______________________

YES OR NO

1. The thermometer tells us whether the air is warm or cold. ______
2. We can change the weather. ______
3. Air is all around us. ______
4. Wind does not help us. _______
5. There is water in the air. ______
6. Dark skies usually mean it will be a nice day. ______
7. The sun heats the earth. _____
8. Dark clouds in the summer usually bring snow. _____
9. Water can go into the air from the earth. ______
10. Clouds act like a blanket, they help store the heat of the earth. _______
11. Clouds are made of water vapor. ______
12. Precipitation means it will not rain. _____
13. Scientists can produce rain by seeding clouds. _____
14. Water has three forms, solid, liquid, and gas. _____
15. Clouds look the same all the time. ______
16. All clouds are very high in the sky. _____
17. The sun is the source of most of the earth's heat. _____
18. Mountains and deserts absorb (take in) different amounts of heat. _____
19. Humidity is the amount of water vapor in the air. _______
20. Clouds are formed when water vapor is condensed. _______

B-PART 3 DEW-POINT TEMPERATURE CHART

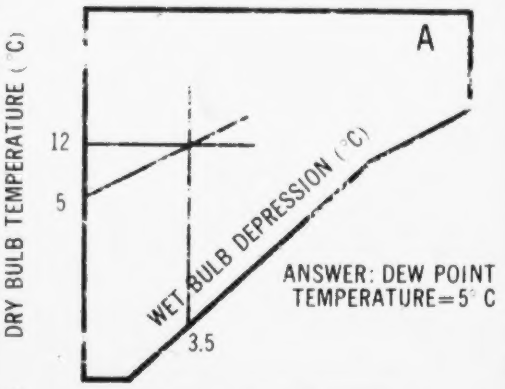


1. To find dew-point temperature (See Example A): Find the dry-bulb temperature along the left side of the chart (12°C). Follow horizontal line to the vertical line for the wet-bulb depression (difference between dry-bulb and wet-bulb temperatures, or 3.5°C). Read the dew-point temperature from sloping line at this intersection (5°C).

2. To find the relative humidity (See Example B): Read the value of the saturation vapor pressure for the dry-bulb temperature at left side of chart. (13.9 mb is saturation vapor pressure for air at 12°C). Read the value of saturation vapor pressure for dew-point temperature also at left side of chart. (8.7 mb is saturation vapor pressure for air at 5°C.) Divide the second value (8.7) by the first (13.9) and multiply by 100. Answer: 63%.

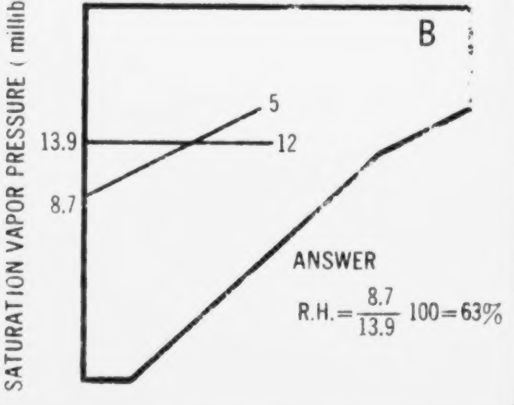
EXAMPLES

FIND THE DEW POINT TEMPERATURE
IF DRY BULB TEMPERATURE=12° C
IF WET BULB TEMPERATURE=8.5° C



ANSWER: DEW POINT TEMPERATURE=5° C

FIND THE RELATIVE HUMIDITY



ANSWER

$$R.H. = \frac{8.7}{13.9}\ 100 = 63\%$$

RELATIVE HUMIDITY IN PERCENTAGES

Dry-bulb temperature (degrees Fahrenheit)	Difference between wet-bulb and dry-bulb readings																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32	34	36	38
22	86	71	58	44	31	17	4																				
24	87	73	60	47	35	22	10																				
26	87	75	63	51	39	27	16	4																			
28	88	76	65	54	43	32	21	10																			
30	89	78	67	56	46	36	26	16	6																		
32	89	79	69	59	49	39	30	20	11	2																	
34	90	81	71	62	52	43	34	25	16	8																	
36	91	82	73	64	55	46	38	29	21	13	5																
38	91	83	75	66	58	50	42	33	25	17	10	2															
40	92	83	75	68	60	52	45	37	29	22	15	7															
42	92	85	77	69	62	55	47	40	33	26	19	12	5														
44	93	85	78	71	63	56	49	43	36	30	23	16	10	4													
46	93	86	79	72	65	58	52	45	39	32	26	20	14	8	2												
48	93	86	79	73	66	60	54	47	41	35	29	23	18	12	7	1											
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5											
52	94	87	81	75	69	63	57	51	46	40	35	29	24	19	14	9											
54	94	88	82	76	70	64	59	53	48	42	37	32	27	22	17	12	3										
56	94	88	82	76	71	65	60	55	40	44	39	34	30	25	20	16	7										
58	94	88	83	77	72	66	61	56	51	46	41	37	32	27	23	18	10	1									
60	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	13	5									
62	94	89	84	79	74	69	64	59	54	50	45	41	36	32	28	24	16	8	1								
64	95	90	84	79	74	70	65	60	56	51	47	43	38	34	30	26	18	11	4								
66	95	90	85	80	75	71	66	61	57	53	48	44	40	36	32	29	21	14	7								
68	95	90	85	80	76	71	67	62	58	54	50	46	42	38	34	31	23	16	10	3							
70	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	25	19	12	6							
72	95	91	86	82	77	73	69	65	61	57	53	49	45	42	38	34	28	21	15	9	3						
74	95	91	86	82	78	74	69	65	61	58	54	50	47	43	39	36	29	23	17	11	5						
76	96	91	87	82	78	74	70	66	62	59	55	51	48	44	41	38	31	25	19	13	8	3					
78	96	91	87	83	79	75	71	67	63	60	56	53	49	46	43	39	33	27	21	16	10	5					
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	35	29	23	18	12	7	3				
82	96	92	88	84	80	76	72	69	65	61	58	55	51	48	45	42	36	30	25	20	14	10	5				
84	96	92	88	84	80	76	73	69	66	62	59	56	52	49	46	43	37	32	26	21	16	12	7	3			
86	96	92	88	84	81	77	73	70	66	63	60	57	53	50	47	44	39	33	28	23	18	14	9	5	1		
88	96	92	88	85	81	77	74	70	67	64	61	57	54	51	48	46	40	35	30	25	20	15	11	7	3		
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	41	36	31	26	22	17	13	9	5	1	
92	96	92	89	85	82	78	75	72	68	65	62	59	56	53	50	48	42	37	32	28	23	19	15	11	7	3	
94	96	93	89	85	82	79	75	72	69	66	63	60	57	54	51	49	43	38	33	29	24	20	16	12	9	5	1
96	96	93	89	86	82	79	76	73	69	66	63	61	58	55	52	50	44	39	35	30	26	22	18	14	10	7	3

Using the Table: Read the dry-bulb and the wet-bulb thermometers. Determine the difference between the readings.

In the left-hand column find the reading of the dry-bulb thermometer. Then read across until you reach the column representing the differences between the wet-bulb and dry-bulb readings. The number you find is the relative humidity expressed as a percentage.

For example, if your reading on the dry-bulb thermometer is 76°F, and on the wet-bulb is 65°F, the difference between the readings is 11°, and the relative humidity is 55%.

WEATHER CHART

DATE	TIME	TEMP.	WIND SPEED	WIND DIRECTION	HUMIDITY	AIR PRESSURE	PRECIPITATION	SKY	FORECAST

UNIT 20

SCIENTIFIC WEIGHTS AND MEASUREMENTS

TERMS

Meter:	Measures length
Liter:	Measures volume
Gram:	Measures weight
Meter stick:	Equivalent to 39.37 inches
Kilo:	Prefix meaning 1000
Milli-:	Prefix meaning 1/1000
Centi-:	Prefix meaning 1/100
Deci-:	Prefex meaning 1/10
Degree:	Unit used in measuring temperature
Centigrade:	Type of thermometer used in scientific work
Fahrenheit:	Thermometer used in everyday living
Calorie:	Quantity of heat required to raise the temperature of one gram of water through one degree C
British Thermal Unit:	Quantity of heat required to raise the temperature of one pound of water through one degree F.

TEACHER INFORMATION:

In science, the metric system is preferred over our usual system. It is much easier to work with when once you have learned it - for instead of dividing or multiplying by 12 or 32 or 16 to go from one unit to the next, you simply move the decimal point.

Length

1 meter = 39.37 inches (meter stick)

1 meter = 1000 millimeters (mm)

1 kilometer (km) = 1000 meters

Volume

1 liter = 1000 cubic centimeters (cc)

1 liter = 1000 milliliters (ml)

1 liter = 1.06 quarts (liquid)

Weight

1 gram = 0.035 ounces

1 gram = 1000 milligrams (mg)

1000 grams = 1 kilogram (kg)

In abbreviating the metric terms,there is no period mark.

Thermometers

Centigrade

Fahrenheit

Conversion

Centigrade temperature = 5/9 X Fahrenheit temp. minus 32

Fahrenheit temperature = 9/5 X Centigrade Temp. plus 32

For example, to change 100 degrees Centigrade to Fahrenheit, take 100 X 9/5 + 32; you end up with 212 Degrees F.

Boil and Freezing points

Fahrenheit - freezing 32 - boiling 212

Centigrade - freezing 0 - boiling 100

ACTIVITIES

1. Using the weights and balances, weigh different articles such as coins, fruit, chemical apparatus, etc.

2. Using the soil sampling kit, weigh the Petridish without the soil and then with the soil to determine the exact weight of the soil. Weigh each of the 5 cups of soil after the soil has been sampled and sieved. Beginning with coarse soil down to the extremely fine soil; after you have found the gram weight of each cup, find the percentage of coarse, medium, fine, very fine, and extremely fine soil.

3. With Fahrenheit thermometers make a daily graph recording each day's temperature at a certain time of the day; at the end of the week, find the average temperature. Using Centigrade thermometers, do the same and convert the temperatures and average to a Fahrenheit reading.

4. Make up problems involving temperature conversions from Fahrenheit to Centigrade, and vice-versa.

QUESTIONS:

1. What type of measurement do we use in our everyday living corresponding to the metric stick?

2. What are two types of thermometers?

3. Is one able to convert a Centigrade reading to a Fahrenheit temperature?

4. Why is mercury used in thermometers?

5. What is a thermostat?

6. What do the little "steps" on thermometers measure?

7. Why isn't water suitable for the liquid in a thermometer?

8. Name the freezing points of the Fahrenheit thermometer.

9. Name the boiling points of the Centigrade thermometer.

10. What does "B.T.U." stand for?

11. In what type of work would the Centigrade thermometer be used?

12. Which unit measures liquids, such as pop, a meter, liter, or gram?

MATERIALS:

Soil Sampling Kit
Gram Weights and Scale
Petri Dish
Stainless Steel Pitchers
Beakers
Erlenmeyer Flasks
Graduated Cylinders
Centimeter Ruler
Meter Stick
Fahrenheit Thermometer
Centigrade Thermometer
Mercury

REFERENCES:

Film Loops and Accompanying Booklets

FL64	Weighing Techniques Part I
FL65	Weighing Techniques Part II
FL66	Measuring Techniques Part I all Grades 4-5-6
FL67	Measuring Techniques Part II

Film Strips

FS59	Measuring Fluid Pressure Grades 4-5-6
FS73	Units of Measurements Grades 4-5-6
FS240	Measurement of Heat Grades 5-6

Transparencies

OHT29	(orig.)	A History of Measurement
OHT46	(orig.)	Heat - measurement, transfer, and effects
OHT176	(orig.)	Physics Series - measurements

Books

Thermometers Heat and Cold
The How and Why Wonder Book of Beginning Science
Weight and Measurement (LMC)
Temperature Measurement (LMC)

UNIT 21

SPACE

THE SOLAR SYSTEM

THINGS TO FIND OUT

1. What is the solar system?
2. What does the solar system contain?
3. What causes day and night?
4. What kind of heavenly body is the moon?
5. Why does the moon look as if it has a face?
6. What makes the moon shine?
7. Why have we never seen one side of the moon?
8. Why, on some nights, do we see a full moon, and on other nights a half or quarter?
9. Are days on the moon the same length as on the earth?
10. Are nights on the moon the same as on the earth?
11. How did the solar system originate? The theories?
12. What is a satellite?
13. Are all planets the same size?
14. Are days and nights on other planets the same length as on the earth?
15. What is gravity?

16. Do all planets have gravity?

17. How does gravity on earth compare with that of other planets?

18. Do all the planets have the same temperature, if not why?

19. What types of gases are found in the solar system?

20. Do all planets contain water?

21. What are comets?

22. What are asteroids?

23. What are meteors?

24. What is the Milky Way?

25. What is a constellation?

26. Do explorers have any use for stars?

27. Are stars of value today? If so, how?

28. What can stars tell you?

29. What is our nearest star?

30. Where are stars located?

31. What does star color indicate?

32. What is a galaxy?

33. Why do stars twinkle and seem to have points?

34. Why do stars appear to rise in the east and set in the west?

35. Why do other stars never rise and set?

36. Where are stars in the daytime?

37. Why do we see different constallations during the different months and seasons?

38. Why is the sky blue?

39. What is atmosphere?

40. How have we probed the near reaches of Space?

41. What are cosmic rays?

42. What are VanAllen belts?

43. What is "Space Debris"?

44. Why will it be difficult to explore Mercury?

45. What will we find on Venus?

46. Is Mars another Earth?

47. What is inner core of Jupiter like?

48. What lies beyond Saturn rings?

49. How did gravity help astronomers discover Neptune?

50. Why is Pluto called "Planet X"?

51. How do astronomers measure distance?

52. How far away are the stars?

53. What is the difference between astrology and astronomy?

54. How were planets named?

55. What holds the Solar System together?

56. Why doesn't the sun burn up?

57. How big is the sun?

58. What is sun made of?

59. How hot is the sun?

ACTIVITIES

1. Work with a globe locating specific places.

2. Wrap globe in layer of cellophane to represent earth's blanket.

3. Have the children cut center from a file card so that they have a picture frame. They can look at things which are at first near to them and then far away. This helps them understand that the sun looks small because it is so far away.

4. Provide a large strong light bulb on an extension cord to represent the sun and a smaller toy globe to represent the earth. Put a tiny paper doll

on the globe. Have each child pretend that he is the doll and that the globe is the real earth. Let the children manipulate the globe and the light to discover what the earth must do in order that the doll may experience both day and night.

5. Locate directions. Using globe and light bulb, rotate the globe counterclockwise to show that the sunrise is in the east and the sunset is in the west.

6. Label children-sun and earth. Put the sun in the large chalk circle in the middle of the floor. Have the earth rotate and revolve around the sun showing day and night and seasons.

7. Build a moon with clay showing mountains, creaters. Use a light to show how the sun shines on the moon and causes it to have day and night. The children should discover that the dark shadows make the moon appear to have a face.

8. Collect photographs and pictures of the moon and other plantes for B.B.

9. Hang simulated planets the children have made, from the ceiling to show the solar system.

10. Using a ball to represent the moon, have the children take turns carrying it around the earth so that one side of the moon is always facing the earth.

11. Take a pretend moon trip planning clothing, food, equipment, etc.

12. Design you own spacecraft. Decide how many members will be in your crew; then plan for food, garbage disposal, etc. How would the crew keep from being bored?

13. Make a reaction-propelled balloon. Blow up a long, narrow balloon and tie a string in a bow around the neck. Attach the balloon to a soda straw, using cellophane tape. Then run a long wire through the soda straw. Attach each end of the wire to a different part of the room, keeping the wire horizontal. Now untie the string so that the air can escape suddenly from the balloon. As the air rushes out in one direction, the balloon moves in the opposite direction. Take a fresh balloon, blow it up, and hold the neck shut with your fingers. Release the balloon suddenly and watch it fly. Does it take a straight path?

14. Learn more about orbits. A satellite which orbits close to the earth must move faster than one which

orbits farther away. Prove it by taking a length of strong string about three feet long. Tie several metal washers or some other small rather heavy weights to one end. The weight will take the place of the satellite and the string will represent the force of the earth's gravity that keeps the weight going round and round. Grasp the string about one foot away from the weight and swing the weight round and round. Notice how fast the weight must go if you are to keep the path of the string flat. Now grasp the string about three feet from the weight. Do you have to make the weight go faster or slower to keep the path of the string flat? Decrease the length of the string while the weight is spinning and see what happens.

15. To show the size of the sun, draw 2 circles on the chalk board, one with a diameter of 13 5/8 inches wide, and the other with a diameter of 1/8 inch wide. The diameter of the large circle labeled "sun" will be 109 times larger than the smaller circle labeled earth. Place the circle 93 inches apart. By letting one inch equal one million miles, 93 inches would indicate the distance of the earth from the sun. If the sun were a hollow ball, more that one million earths would fit inside.

16. Make a chalk diagram of the sun and planets. Compare size of planets with each other, with the sun and relative distances from the sun.

TABLE - DIMENSIONS AND DISTANCES FOR A CHALKBOARD DIAGRAM OF THE SUN AND PLANETS

BODY	DIAMETER	DISTANCE
Sun	27"	
Mercury	1/8"	1 3/4"
Venus	1/4"	3 1/4"
Earth	1/4"	4 3/4"
Mars	1/8"	7"
Jupiter	2 3/4"	2 Ft.
Saturn	2 3/8"	3 Ft. 8"
Uranus	1"	7 Ft. 5"
Neptune	7/8"	11 Ft. 8"
Pluto	1/8"	15 Ft. 3"

17. We see planets by reflective light. Darken the room let a rubber ball represent a planet. In a closet or a room that can be completely darkened, the planet cannot be seen at all. Let a lighted flashlight represent the sun. When the sunlight of the flashlight shines on the planet, the planet

can now be seen because the light is reflected to the eye. Planets do not give off their own light.

18. Why planets revolve around the sun: Attach a string that is three feet long to a ball or eraser. Hold one end of the string in your hand and whirl the ball around your head. Then let go of the string suddenly and note how the ball travels in a straight line. (Newton's first law of motion). Whirl the ball around your head again. Note how your hand must pull inward on the string so that the ball will travel around in a circle and not fly out. This pull on the string corresponds to the pull of gravity whereas the tendency of the ball is to fly out and travel in a straight line corresponds to a force due to inertia. Both forces act on a planet so that the planet neither fall toward the sun nor flys straight out into space. It travels around the sun instead.

19. Gravity
    Let a ball drop to the ground. The earth's gravity pulls the ball to the ground. Jump into the air--earth's gravity pulls you down. Have a child stand with a hand stretched straight out palm up--place a heavy book on the child's palm. He soon will feel earth's pull of gravity on the book.

20. Observe morning and evening stars--Venus and Jupiter--They can be easily identified because they are brighter than real stars. Just above the horizon at sunrise and just above the horizon at sunset.

21. Have the children read about the different theories of the formation of the solar system. Discuss merits and drawbacks of each theory.

22. Life on other planets
    Have children read about conditions such as temperature, atmosphere, and water on other planets and discuss possibility of life as it exists on earth on these planets.

23. Have children present ways that help them realize the earth is round.

24. Have children find other things in every day life which rotate on axis - e.g., merry-go-round.

25. Make a sun-dial
Place a short pencil upright in a lump of clay. Set the pencil on a blank paper on a window which gets sunlight all day - draw a semi-circle around the pencil using the length of the pencil as the radius and position of the clay as the center of circle. The pencil will cast a shadow on the paper. Mark the position of the shadow at every hour drawing a line along the shadow and extending it until it reach the semi-circle write down the hour when this shadow occured.

26. Only a small amount of the sun's energy reaches the earth. Set up a goose-neck or a table lamp without a shade at one end of a long table and a marble at the other end. Point out that the bulb or sun sends out light in all directions. The marble or earth receives only a small part of sun's energy.

27. Compile a scrapbook from old newspapers and magazines about moon exploration.

28. Stars differ in color.
Heat a piece of wire until it glows. As wire gets hotter and cooler note the color changes. This is the same principal in stars.

29. Make a bulletin board to show constellations. Use dark blue background, paste silver stars to show constellations and patterns.

30. Pretend you are living on another planet. Write a story about your life there.

31. Pick a planet-- tell about its atmosphere, size, color, etc.

32. Write about what you think it would be like to be lost in space.

REFERENCES

Books

Science for the Elementary School, Victor Edward, Teacher Ref. LMC
The Teaching of Science in Elementary School, Potter, Lewis Teacher Ref. LMC
Stars, Golden Nature Guide, Indiv. copies LMC
Space, Tellander, KEL
Planets, Life Science Library, LMC
A Book of Stars for You, Branley, KEL
How and Why Book of Stars, Golden Book, KEL
How and Why of Planets & Interplanetary Travel, KEL

The Universe, Berganini, KEL
Planets, Stars & Space, Chamberlain, Nicholson, KEL

Film Strips

FS79	Gravitation 2-6 difficult
FS80	Rotary Motion 2-6 difficult
FS81	Centrifugal Force 2-6 difficult
FS170	Constellation 2-6 color good (FOM550)
FS172	The Earth Satellite 2-4 (FOM562)
FS173	The Astronomer at Work 2-4 (FOM572)
FS175	Rocket to the Moon 2-6 (FOM580)
FS178	New Disc. About Earth 2-6 (FOM589)
FS459	The Air Age 2-6
FS463	The Starry Universe 2-6 (Part XIII of WWL. I Series)
FS470	The Sun's Awesome Impact 2-6 (Part VII of N.P.O.P.)
FS471	Earth's Magnetism 3-6 (Part VIII of N.P.O. P.S.)
FS487-496	Walt Disney's Series
487	Man Becomes Astronomer 2-6 (Pictures for K. & 1)
488	Man & Moon "
489	Man Learns to Fly "
490	Man in Flight "
491	Man in Space "
492	Flight into Space "
493	Flight Around the Moon "
494	Flight to Mars "
495	Man Discovers the Atom "
496	Our Friend the Atom "
FS504	Our Earth in Motion 3-6
505	The Sun and Our Seasons 5-6
506	What is Weather
713	Exploring the Moon 3-6
669-674	The Earth and Its Neighbors in Space 2-6
714	Plants and Comets 3-6
715	Exploring the Sun 3-6
716	Milky Way and Other Galaxies 3-6
717	Nebulae 3-6
718	The Universe in Color 3-6
736	What is Space 2-4
737	Rockets to Space 2-4
738	Getting Ready for Space Trip 2-4
739	What are Satellites 2-4
740	Space Trip to the Moon 2-4
FS775	Multitude of Suns 2-6
776	Stories of Constellations 2-6
777	Sun's Family 2-6
778	Interesting Things About the Planet 2-6
779	Our Neighbor the Moon 2-6
780	The Changing Moon 2-6
781	How We Learn About the Sky 2-6

Pamphlets

T.A.75 Space (for use with New Book of Knowledge)

Slides

SL1	The Moon Lunar Eclipse	all grades
9	The other Side of Moon	"
10	" " " " " (Map)	"
12	The Sun With Spots	"
13	Rotation of Sun With Spots	"
14	Large Sunspot	"
15	Solar Spectrum	"
20	Partial Phases of Solar Eclipse	"
21	Solar Eclipse	"
25-47	Slides on Stars	"

Transparencies

OHT15	The Moon (18)
54	Star and Constellation Recognition
270	Earth and Moon-Lunar Orbit
271	Surface of Moon
4	Day and Night Series

UNIT 22

FLIGHT

THINGS TO FIND OUT

1. Who was the first man to fly?
2. How did the first balloonists fly?
3. Why did the hydrogen balloon fly?
4. How does the dirigible differ from the balloon?
5. What is a zeppelin?
6. How does a glider fly?
7. How did airplanes shrink the world?
8. How did the helicopter originate?
9. How does the helicopter fly?
10. How do the modern ornithopters fly?
11. Why does an airplane fly?
12. What makes an airplane go up and down?
13. What is lift?
14. What are the airways?
15. Which plane has the right of way?
16. How do the airmarkers help pilots fly?
17. How do pilots fly in all types of weather?

18. What is the sound barrier and how did it change the shape of planes?

19. What will future jets be like?

20. What makes a rocket fly?

21. What is a guided missile?

22. Why does a satelite stay up in the sky?

23. What do satelites see and tell?

24. What is escape velocity?

25. How can we navigate in a space ship?

26. Why is re-entry a problem?

27. What are the dangers to man in space travel?

28. How does man's mind function in space travel?

29. What is the"G" factor?

30. How does a space suit help a pilot?

31. How does a space man train for the high "G" factors?

32. How does "weightlessness" affect man?

33. How important is "reaction time"? Is it important in space travel?

34. Why are space stations needed?

35. How are moon sites choosen?

36. What did man find on the moon?

37. Will man be able to live on the moon?

ACTIVITIES

1. How does a jet fly? Take an inflated balloon and let it go--the air inside the balloon will escape.

2. Demonstration of lift
Take a piece of paper about two inches wide and five inches long. Fold it an-inch from the end. Hold the paper with your forefinger and thumb, so that the fold is about an inch or two away from your mouth. Blow over the top of the paper. The paper moves up or lifts. By increasing the speed

of the air over the top of the paper you have reduced the pressure causing the paper to rise.

3. How a plane moves up or down
   Take a 3x5 index card and fold a one inch section along the long edge upward at a 45 degree angle. Paste the card along its short center line to a piece of balsa wood about ten inches long. Balance the wood with the attached card on a round pencil like a see-saw. Mark this balanced point and push a straight pin through the balsa so that it is parallel to the card. Hold the pin lightly between the thumb and forefinger of both hands. Hold the wood in front of your mouth, the card farthest away. Now when you blow the raised portion of the index card it acts like the plane's elevator. The front part of the balsa wood will move upward like the nose of the plane. See page 28, HOW AND WHY OF FLIGHT - KEL

4. Helicopter
   Get a 6 inch model airplane propeller, an empty spool, a dowel that just slides through the hole in the spool and a piece of string about two feet long. Nail the propeller to one end of the dowel, wind string around dowel about one inch below the propeller. Then slide dowel into the spool. Pull the string hard and quickly. The propeller spins and lifts the dowel straight into the air. p. 21, same as above.

5. Lift
   Place one end of the sheet of paper in the pages of a book so the paper hangs down. Hold top of book level with book and blow over top of paper. Sheet of paper will rise because the fast moving stream of air across the top of the paper causes air pressure on top. Surface pressure will be less than pressure underneath paper.

6. Affect of wing spread on lift
   Obtain two model planes, one with a larger wing spread than the other. Point out that the greater the wing spread the more air that passes over and under the wings and the greater the lift will be.

7. Angle of attack
   Demonstrate with model plane that wing is tilted at a slant so that the air can strike the under side of the wing as well.

8. Action and Reaction (Newton)
   Obtain a plastic bottle preferably a flat one, and a cork to fit the mouth of the bottle. Place a teaspoon of baking soda on a small piece of tissue--

wrap the tissue into a row and twist the ends. Fill bottle 1/3 full of vinegar. Drop the roll into the bottle and shake once, in order to break up the roll. Push cork into bottle. Immediately place the bottle on three or four ound pencils. Shortly the cork will blow out f the bottle. The bottle will move in the direction opposite to that of the cork. p. 425 Science for Elementary School, Victor.

9. Drag
   Have a child hold a large cardboard in front of him and run into the wind. The resistance of the air against the cardboard will produce a drag and slow down of child's foreward motion.

10. Have a child bring in a model airplane and tell about the different parts and tell their uses.

11. Visit the airport to view the runways.

12. Obtain model airplane kits and put them together at school.

13. Compare structure of the bird to the airplane.

14. Have the children read about and report about early space explorations with rockets.

15. Make bulletin boards on: Early space flights, space craft, astronauts, astronauts' families, recent space flights, etc. Perhaps teachers may wish to have students work in groups on these or other subjects.

16. Draw or make model of multi-stage rocket. Older children may wish to explain function of each stage.

17. Find out how to prepare for a career as an astronaut or other jobs in aviation.

18. Have the children read and report about problems of astronauts they may encounter in space weightlessness, food and water, sufficient oxygen disposal of wastes, heat and cold and mental problems caused by isolation.

19. Have children give reports on uses of airplanes to man.

20. Make model airplane--model and pattern in AIRPLANES, Victor.

21. Experiment with G. forces
    In an auto ask the driver to accelerate suddenly so

that you can feel the force of the speeding up. Is your body thrown foreward or backward? Do you feel the same with different rates of acceleration?

22. Put brakes on suddenly on your bike--you are experiencing deceleration. Can there be dangers of this in a car? How would seat belts help?

23. Almost weightlessness
Can you sit on the bottom of a pool? Try eating a banana under water. Open a can of pop under water. Figure out how you could drink pop under water if you were really weightless.

24. Build a model airport.

25. Make a lunar model out of cardboard, etc. in the room.

REFERENCES

Books

Aircraft and How They Work, Gottlieb KEL
The Second Book of Experiments, DeVries JHL
700 Science Experiments for Everyone, Unesco JHL
Man and Space, Life Science Library JHL
Balloons, Burchard KEL
Airplanes, Follett KEL
Rockets, Follett Kel
Astronautics, May KEL
Flight, How and Why Wonder Book KEL
Planets and Interplanetary Travel, How and Why. . . KEL
True Book Airports and Airplanes, Lewellen KEL
The Book of Experiments, DeVries JHL
Real Book of Science Experiments., Leeming JHL
Jets and Rockets and How They Work, Gottlieb, KEL
At The Airport, Colonius KEL
Project Mercury, Coombs KEL
Flight, Life Science Library JHL
The Encyclopedia of Aviation and Space Sciences, Vol. 5-14 JHL
Beginning Science Experiments, How and Why. , KEL

Filmstrips

FS174	Rocket to the Moon
459	The Air Age Life Film 2-6
487-493	Space and Atom - Walt Disney K-4
498-503	Airplanes Jets and Rockets 1-4
736-741	First Adventure in Space Series 1-4
1368	Space Travel K-3

Maps - Charts

Map C-88 Charts on Space LMC

Pamphlets

Pam T.A.75 Space 1-6 Elementary-suggested activities-
Use with New Book of Knowledge
T.A.154 - Very good K-6
1. Space Travel and Rockets
2. NASA Apollo Project Moon Landing 196

Transparencies

OHT 37 Story of Flight No. 29 1-6

Records

R509	Man on the Moon
R510	Sounds of the Space Age --From Sputnik to Lunar Landing

UNIT 23

THE SENSES

THINGS TO FIND OUT

1. What are the senses?
2. What does the eye look like?
3. How do we see?
4. What is the blind spot?
5. Why do we see better with two eyes rather than one?
6. What does the ear look like?
7. How do we hear?
8. Why do we hear better with two ears than one?
9. Why do we smell odors?
10. Can the sense of smell get tired or lost?
11. How do we taste things?
12. How do we feel things?
13. Are all areas of the skin equally sensitive to the touch?
14. How are your eyes protected?

ACTIVITIES - EYE

1. Stand in front of a mirror in a brightly lit room--you can easily see the pupil of your eye widen and narrow.

2. Cover one eye with your hand for 90 seconds. Suddenly remove your hand and look at the eye that was covered. You will see the pupil narrow.

3. Blind Spot--On a file card place an X on one end and a dot on the other. Close your left eye and hold the card before you open right eye. Fix your gaze on the X. Now move the card toward you and away from you until you find the point where the dot completely disappears.

4. We see better with two eyes rather than one. Place a table directly beneath the light stand about eight feet in front of the table. Crouch down so that eyes are level with the tablestop and close one eye. Ask someone to stand a spool in the center of the table. Ask him also to place another spool of the same size about four inches in front or in back of the first spool but not to tell you whether the second spool is in front or behind the first. Try to guess location of the second spool. With both eyes open, repeat your guessing. Your score should improve.

5. Memory eye game - Look at a number of objects--take one away, any object - try to remember what it was. See Peabody kit.

6. Make a large chart showing the parts of the eye.

ACTIVITIES-TASTE

1. Test affect of smell in tasting. Plug nose and blindfold person--see if he can tell the difference between an onion, potato or apple.

2. Test for different areas of sensitivity of the tongue by placing something salty, sweet, bitter or sour on the different areas of the tongue.

3. Bring in different foods and taste them.

ACTIVITIES-EARS

1. Record different sound on a recorder or take from a record. Have children identify sound.

2. Who is talking? (Game)

3. Where is the sound coming from. Have child close eyes and determine direction of sound.

4. Make a chart showing parts of ear.

5. Place a hand tightly over one ear. Have someone clap his hands once in some part of the room. Point to where you think the sound is. Repeat activity as person moves from place to place around the room. Repeat activity and see if score improves.

ACTIVITIES-SMELL

1. Bring in various strong and weak smelling foods. Blindfolded try to determine what the food is.

2. Test for tiredness in sense of smell by placing a strong odor in the room and seeing if you can still smell it later in the day.

ACTIVITIES-TOUCH

1. Place an object in a box. Feel to see if you can tell what it is.

2. Show that skin is not equally sensitive by pressing palm with a pencil point. Repeat by using two pencil points. Try to guess how many points are pressing on your hand each time. Repeat experiment using skin on upper back close to spine. It will be more difficult to tell on your back.

REFERENCES

Books

Human Body, How and Why Wonder Book, KEL
Look At Your Eyes, Showers, 1-3
How To Talk, " "
Hear Your Heart " "
Straight Hair, Curly Hair, Goldin 1-3

See Peabody Kit
Excellent sense training games located in manual

Transparencies

OHT174 Structure of Ear, Inner, Middle and Outer
OHT175 Structure of Eye

Records

R81	Animal Sounds
R82	Traffic Noises
R278-281	Circus Fun and Ball Bouncing
R352	Investigation
R356	Elementary Rhythms
R362	Rhythm Time

Film

FS475	The Eyes and Their Care
FS484	Ears and Hearing
FS938	How We See
FS939	The Story of Lenses

Redia - REA 21 The Human Body (Chart four)
4) Olfactory Organs- Organs of Sense, Taste

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Miscellaneous Films

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AMERICA IN SPACE Space efforts of U.S.	National Aeronautics and Space Administration NASA Ames Research Center Public Affairs Office Moffitt Field, California 94035
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TOMMY LOOKS AT SPACE	Farm Film Foundation The B.F. Goodrich Company Sterling-Movies U.S.A. Inc. 1425 H Street, Northwest Washington, D.C. 20005
LITTERBUG, DISNEY PRODUCTION Donald Duck	Associated Films 25358 Cypress Avenue Hayward, California 94544
FOOD FOR SPACE TRAVELERS	National Aeronautics & Space Administration NASA Ames Research Center Public Affairs Office Moffitt Field, California 94035

LANDING ON THE MOON	National Aeronautics & Space Administration NASA Ames Research Center Public Affairs Office Moffitt Field, California 94035
LIVING IN SPACE Problems man must solve in space--water, food, waste disposal	National Aeronautics & Space Administration NASA Ames Research Center Public Affairs Office Moffitt Field, California 94035
ROCKET SAFETY	Thiokol Chemical Corporation Bristol Office Advertising Department Film Library - Building #16 Bristol, Pennsylvania 19007
SPACE NAVIGATION Interplanetary flight, imaginary trip to Mars	Department of the Air Force Airforce Film Library Center 8900 South Broadway Saint Louis, Missouri 36125
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TREK TO THE TETONS Wildlife found in Tetons	Eastman Kodak Company Audio-Visual Service 343 State Street Rochester, New York 14650

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